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THE

MALAYAN AGRICULTURAL JOURNAL

Vol. XXX, 1947.

Printed by
Charles Grenier & Son, Ltd.,
Kuala Lumpur.

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TO THE

Malayan Agricultural Journal

Vol. XXX, 1947.

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MESSAGE

from

HIS EXCELLENCY SIR EDWARD GENT,

K.C.M.G., D.S.O., O.B.E., M.C.,

GOVERNOR OF THE MALAYAN UNION.

I am very glad that the *Malayan Agricultural Journal*, which was widely read and appreciated before the War, is resuming publication after five years of silence and I hope that all its old readers will start taking it regularly again and that it will find a large number of new ones.

Agriculture is one of the most important and worthwhile pursuits to which man can devote himself. For some it is a refreshing and absorbing interest outside their main business occupation, but for most it is the chief or only means of livelihood. It is also a science in which as in other sciences, new discoveries are continually being made and useful information derived from them. The modern agriculturist must be up-to-date, and must know what aid science can give him, and he must profit by the researches of others. He must also for his own part seek the active assistance of scientists in the practical problems of his own experience.

A regular publication such as this affords the means by which this can be done, and the need for it has never been greater. I wish it every success.

E. E. Gent.

GOVERNOR,
MALAYAN UNION.

FOREWORD

It is with very great pleasure that the Department of Agriculture is able to announce the re-appearance of the *Malayan Agricultural Journal* after a break of some five years. It can be regarded, I feel, as another step forward in the general re-establishment of the pre-war activities of the Department and further proof of the general upward trend of events, both agriculturally and otherwise, in Malaya.

Since the re-occupation, the Department's policy has been concerned chiefly with food production and general rehabilitation and whilst gradually getting into stride again, there is much to be done. Long range plans have been submitted and are now under consideration by Government concerning:

(a) the establishment of a Central Government Fruit Experiment Station;
(b) the rehabilitation of rubber small-holdings with high-yielding clonal material;
(c) canning and food preservation;
(d) the expansion of the School of Agriculture, Malaya, at Serdang; and
(e) the livestock industry.

The advisory services provided by the Department of Agriculture both economically and technically are required more than ever at the present time. It is hoped, therefore, that the Journal will prove an additional medium in keeping the agricultural community and the public who are interested in the agricultural welfare and development of Malaya in close touch with the activities of the Department.

F. Bamber

Director of Agriculture,
Malaya.

KUALA LUMPUR,
6th January, 1947.

THE

Malayan Agricultural Journal

JANUARY, 1947

EDITORIAL.

After a lapse of five years *The Malayan Agricultural Journal* makes its reappearance, but for 1947 it will be published quarterly only. It was felt that it was desirable to recommence publication as early as possible, but it was also appreciated that, with the need to initiate afresh the experimental work of the Department of Agriculture, material would not yet be forthcoming as readily as formerly to report the results of research and experimentation.

The Department was fortunate in being able to resume active work through its Field Branch shortly after the liberation of Malaya. The staff of Agricultural Officers in this Branch is almost back to its pre-war strength, and officers have been seconded to Borneo, Sarawak and Brunei to assist those countries in the rehabilitation of their agricultural resources. The Department has suffered the loss of a number of officers who died as prisoners of war, and has also lost the services of several senior officers through retirement. Other officers are still unfit for duty, and the Research Branch has had to meet demands for its assistance with a seriously reduced personnel.

We are glad to have this opportunity of paying a public tribute to the loyalty of the Subordinate Staff of the Department. In the Field, technical subordinate officers maintained agricultural services during the occupation and did their best to assist the small-holder with rice and foodcrop cultivation under most difficult conditions. European officers who were interned have learned, since their return, with a considerable sense of gratitude, of the efforts made by two local Headquarters officers to alleviate internment conditions by sending money and food supplies to Singapore. The Departmental library was maintained almost intact, and valuable statistical and other records were preserved through the loyalty of the clerical staff.

Vegetable Cultivation at Cameron Highlands. Before the occupation, vegetable growers at Cameron Highlands had a ready sale for their produce in Ipoh, Kuala Lumpur and as far away as Singapore, but the industry remained of modest proportions in view of the large supplies available from the Netherlands Indies at low prices.

An article in this issue describes present conditions of the industry at Cameron Highlands and shows that, with ruling high prices and a steady, big demand for vegetables, it has become most profitable and gives an astonishingly high return to the growers. That competition from Java and Sumatra must be expected at a later date is admitted, and the article is primarily concerned with making recommendations for the more economical production of vegetables based on the results of experiments carried out prior to the war in this country. Attention is drawn to the very heavy expense incurred by the Chinese market-gardener in the maintenance of the fertility of his holding by the use of artificial fertilizers and expensive supplies of prawn dust and fish refuse, all of which have to be transported to the Highlands from the plains. The author of the article contends that this expenditure is incurred, not for the provision of the mineral nutrients for the growing crop, but in providing the organic matter necessary for the maintenance of the physical structure and biological activity of the soil.

Observations indicate that with large bulk dressings of compost, of the order of 50 tons per acre per crop, full fertility of the land is retained and the need for artificial fertilizers is reduced with most crops.

The provision of large quantities of green matter for bulk compost dressings is a major problem. The author points out, however, that the market gardener usually has less than ½ acre under vegetables out of a holding of 2 to 3 acres, the remaining land being abandoned to weeds and secondary jungle growth. The proportion of green cover required for composting is 6 acres to 1 acre cash-crop, or roughly the proportion of the uncultivated portion of a holding to the cultivated portion. It is suggested, therefore, that the market-gardener should make use of the remainder of his land to grow green cover and thus save the heavy expenditure on fertilizers. By this means vegetable cultivation on the Highlands could be developed on a much sounder economic basis and so be ready to meet the eventual competition of imported vegetables.

Work in P. O. W. Camps.

Although the article on biochemical work in a P.O.W. camp in Thailand has no connexion with argiculture, we do not think any apology is necessary for reprinting it in this Journal. The author is a member of the Department of Agriculture, Malaya, and the article is an extremely interesting and first-hand account of difficult work accomplished under the most arduous conditions, which cannot fail to be of interest to all readers. We are indebted to the *Pharmaceutical Journal* for permission to reprint this article.

Another article in this issue also deals with conditions in a P.O.W. camp. It is also by an officer of the Department of Agriculture, and describes the methods adopted to compost all available waste matter under hygienic conditions to maintain the fertility of a poor soil under exhaustive cropping of vegetables. The results obtained show unmistakably the value of compost as a means of keeping land in good heart, and bear out the recommendations of the Department of Agriculture over a long period of years.

Original Articles.

VEGETABLE PRODUCTION AT CAMERON HIGHLANDS

BY

B. A. LOWE,

Agricultural Officer, Cameron Highlands.

Cameron Highlands district with its elevation varying between 3,000 and 5,000 feet above sea level has been able to develop an important minor industry in the production of vegetables which cannot be produced commercially in the low country. Commencing with a small output when access to the district was first made possible in 1930, production has steadily increased and, for several years prior to the Japanese occupation, output increased rapidly. From 500 tons in 1938, it doubled in 1939, redoubled in 1940 and reached the considerable total of nearly 4,000 tons in 1941.

The Japanese were not slow in appreciating the potentialities of this vegetable trade, especially in view of their food production drive. A Japanese gardener, with some years of local residence prior to the occupation, returned and assumed a monopoly of the trade. An octroi post was erected on the only access road, and the former vegetable grower exacted a handsome toll on all produce passing his gate. He gave every encouragement to vegetable production, and gardeners cheerfully accepted the chance of selecting the best available land in Forest Reserves, Town Board areas, and on estates abandoned by former owners. An influx of gardeners—some of whom were previously employed in producing tin in the Kinta Valley—resulted. To many, the comparative isolation of the Highland valleys, with a minimum of official interference was an attraction; to others, the possibility of a rapid disappearance into the adjacent forest was desirable; and to all, vegetables offered a valuable source of income and of food.

As a result of this increase in the market-garden population, the pre-war record of annually increased production was maintained. With the exit of the Japanese, the grower found from the first month of our return that his market was better and better. British forces were insistent on supplies of cabbages, leeks, and tomatoes as soon as they found the source of supply, shortly after the re-occupation. There has been little competition from imports from the Netherlands Indies, Hong Kong or Australia, factors of some importance in pre-war days, and there appears to be an increasing demand from the wealthier Asiatic population, and especially the restaurant trade, for temperate climate vegetables.

Prices have therefore been very high and have shown handsome profits. At the time of writing (early November 1946) an average cabbage is worth 80 cents, and 1 acre will produce 20,000 cabbages in three months. It should be added that, under local conditions, failure of a cabbage crop

is rare, and every one produced finds an immediate sale. It is of interest to record that, at the end of 1945, unrooted cabbage sprouts were selling freely at 50-60 cents each, a price which gives an indication of the value of the crop at that time. (It is customary, locally, to grow cabbage from the sprouts which appear after the " heart " has been harvested. Seed is rarely used).

Marketing and transport conditions have been such during the past year, that it is difficult to make any accurate estimate of the annual production for 1946. From such figures as have been obtained, it is believed that the year will have seen a production of something like 8,000 tons, valued at approximately $500 per ton to the grower, giving an astounding total gross income of $4 million to a district of roughly 1,000 acres of vegetable land with a population of 7,000, of whom not more than one-half are engaged in vegetable production as a full-time occupation. In addition, estimating from retail values, a sum at least twice as great, i.e. $8 million, may well have been made by the wholesalers, the transporters, and the retailers at urban markets.

The demand for hill vegetables seems insatiable, and with the probability of a permanently increased European population, there appears every likelihood of an increase rather than a diminution in the importance of this local industry. It is, however, certain that competition from imports will have to be faced, as growers elsewhere overseas will not be slow to invade a market with retail values of £200 per ton for cabbage and other vegetables not in the luxury class.

In order to be in a position to meet such competition, it is desirable that the local gardener should consider the economics of his holding and question methods which are wasteful.

The market gardener in South China has developed methods of husbandry which in his own country are traditional and which have been proved sound by the retention of fertility over many centuries. These methods are based primarily on dressings of fertilizers such as bean cake, excreta, fish waste, and household ash soaked in urine and nightsoil. There is a winter-fallow, and the garden is usually on flat land subject to flooding which leaves a deposit of silt and organic matter. Such traditional methods have been brought to Malaya, where conditions are entirely different from those of South China. In Cameron Highlands the market gardener crops the land the year round, and for his fertilizer he buys fish and prawn waste which his ancestors have used for centuries. Excreta is invariably used. But there is no winter-fallow here, nor does a flood leave a deposit of silt upon the land cultivated the previous year.

Local vegetable holdings, usually 2-3 acres in extent, have less than ½ acre under crop. The balance is abandoned to weeds and secondary jungle. This is a result of the introduction of methods satisfactory in China to entirely different conditions in Malaya. From time to time, the gardener shifts his cultivation and takes in an area which has been fallowed—i.e.

abandoned—for several years. A new holding, freshly acquired from forest, is cultivated in full for several crops; the major part is then abandoned as yields fall, and cultivation is concentrated on a comparatively small portion of the total holding. As the initial fertility of the forest soil declines, increasing reliance is placed on purchased fertilizers until dressings of ½-1 kati of prawn-dust and fish waste are used in the production of a single cabbage. As an acre carries approximately 20,000 cabbages, something between 6 and 12 tons per acre of these fertilizers may be used for a three-months crop. At present prices, the cost of such dressings may be $2,000-$4,000. However great wastage under conditions of high rainfall might be, such expenditure, merely on mineral nutrients removed by the crop, would be absurd. The equivalent amount of nitrogen, applied as sulphate of ammonia instead of fish and prawn refuse, would require dressings as high as 25-50 cwts. per acre.

Therefore it is maintained that the gardener is not merely purchasing the mineral requirements of his crop. He is primarily purchasing the organic matter necessary for the maintenance of the physical structure and biological activity of his soil. For this organic matter he is paying over $300 per ton (less the value of the minerals contained), while he is surrounded by almost limitless perennial vegetable matter which would be an equally effective, or better, source of fertility. This is available for no more than the labour of cutting, handling, and conversion to a form suitable for incorporation in the soil.

Although the pre-war value of fish waste was one-sixth of the present price, this contention was believed to hold good even then. In order to obtain more definite information, simple observation plots were laid down at the Agricultural Station, Cameron Highlands, in 1939 to investigate the effects of bulky organic matter in the form of compost, with and without dressings of inorganic fertilizers. Two areas of land were chosen, one with high initial fertility resulting from several years of heavy dressing with compost, the other exhausted by an overgrown tea nursery. Each area measured 16 ft. x 80 ft. divided into 4 beds 4 ft. wide. These beds were dressed with compost applied for each crop at rates of 25, 50 and 100 tons per acre with one bed receiving no dressing. Across these beds, five strips 16 ft. long were dressed with artificial fertilizers, giving 4 plots 4 ft. x 16 ft. for each dressing as follows:—ammonium sulphate, 900 lbs. per acre; sodium nitrate, 1,200 lbs. per acre; ammonium sulphate 900 lbs. plus superphosphate 900 lbs. per acre; sodium nitrate 1,200 lbs. plus superphosphate 900 lbs. per acre; and one strip without artificial fertilizers. Summaries of the yields of six crops grown on these plots are recorded in Tables I and II. Table I shows results of varying dressings of compost with constant artificials, Table II shows results of the varying dressings of artificials with constant dressings of compost.

Table I.

Total Bed Yields with Different Dressings of Compost and Equal Dressings of Artificials.

Section A. On land with high initial fertility.

Crop.	Compost dressing in tons per acre per crop.			
	0	25	50	100
	Yields in lbs.			
1. Lettuce ..	72.5	125.2	128.9	98.5
2. Cabbage ..	328.4	386.1	403.1	423.3
3. Parsnips ..	79.6	136.7	152.4	173.2
4. Dwarf Beans ..	2.0	10.2	15.5	14.5
5. Lettuce ..	39.5	84.7	161.2	151.4
6. Turnips ..	36.5	53.9	51.1	66.1
Total ..	558.5	796.8	912.2	927.0

Section B. On land with low initial fertility.

Crop.	Compost dressing in tons per acre per crop.			
	0	25	50	100
		Yields in lbs.		
1. Lettuce ..	0	6.4	64.6	150.9
2. Cabbage ..	28.0	196.1	353.4	444.6
3. Parsnips ..	0.5	31.1	130.7	167.2
4. Dwarf Beans ..	0	11.4	35.2	38.7
5. Lettuce ..	0	111.5	140.4	143.4
6. Turnips ..	19.1	124.1	81.4	64.2
Total ..	47.6	480.6	805.7	1,009.0

Each of the above beds measured 4 ft. x 80 ft. or 1/136th acre. The six crops recorded above occupied the land from 13th June, 1939, to 11th August, 1941, and the observations were continued until the Japanese occupation.

Table II.

Total Strip Yields with Different Dressings of Artificials and Equal Dressings of Compost.

Section A. On land with high initial fertility.

Crop.	Fertilizer dressing in lbs. per acre.				
	Nil	Ammonium Sulphate 900	Sodium Nitrate 1,200	Ammonium Sulphate 900 Superphos: 900	Sod: Nit: 1,200 Superphos: 900
	Yields in lbs.				
1. Lettuce ..	105.5	63.7	82.5	81.5	91.9
2. Cabbage ..	163.5	305.2	366.8	351.2	354.2
3. Parsnips ..	110.4	101.6	105.0	99.0	125.4
4. Dwarf Beans ..	10.4	7.5	6.2	9.7	7.7
5. Lettuce ..	62.5	86.9	88.0	92.1	110.4
6. Turnips ..	43.4	36.2	31.7	42.7	67.0
Total ..	495.7	601.1	680.2	676.2	756.6

Section B. On land with low initial fertility.

Crop.	Fertilizer dressing in lbs. per acre.				
	Nil	Ammonium Sulphate 900	Sodium Nitrate 1,200	Ammonium Sulphate 900 Superphos: 900	Sod: Nit: 1,200 Superphos: 900
	Yields in lbs.				
1. Lettuce ..	39.9	21 1	50.1	42.4	68.4
2. Cabbage ..	116.8	172.1	242.1	218.0	271.0
3. Parsnips ..	61.2	59.2	62.0	65.8	84.7
4. Dwarf Beans ..	14.6	13.9	14.1	17.5	25.2
5. Lettuce ..	80.0	63.6	85.5	80.8	84.8
6. Turnips ..	62.4	52.7	50.0	44.6	79.1
Total ..	374.9	382.6	503.8	469.1	613.2..

Each of the above strips measured 16 ft. x 16 ft., or 1/170th acre. The six crops recorded above occupied the land from 13th June, 1939, to 11th August, 1941, and the observations were continued until the Japanese occupation.

Considering first the effect of compost on land in poor heart, no worthwhile crop was obtained without compost even with heavy application of artificials. Four out of the six crops were, in fact, complete failures. With 25-ton dressings of compost, fair crops were obtained, and it was observed that plots receiving artificials were better than those without. The soil, however, did not darken appreciably with each successive crop, nor did the fertility of the land appear to be increasing. With the 50-ton dressing, a high level of fertility appeared to be achieved at the first crop. The 100-ton dressing gave consistently maximum yields but appeared unnecessarily extravagant.

On the land which started in "good heart", there appeared to be a marked decline in fertility after the second crop, where no compost was applied. The 25-ton dressing kept fertility going fairly well, while 50 tons and over gave high yields.

In examination of the yields shown in the tables, the sixth crop, turnips, should not be regarded as typical. This crop is subject to severe loss through attacks of *Bacillus caratovorus* which results in rot. These attacks are of increasing severity with increased rates of compost dressing. This crop is therefore not typical in its response to manurial treatment.

The deduction is, therefore, that, if approximately 50 tons of compost per acre can be applied to each crop, full fertility of the land is retained. The response of cabbage to increased nitrogen suggests that dressings of inorganic nitrogen to this crop may be more markedly advantageous in the presence of adequate organic matter. The particular response of turnips may also require special consideration.

The cost of production of compost was considered concurrently with the running of the observation plots on its use. As the provision of green matter is locally the major item in the production of compost, plots of bushy leguminous cover-crops (*Tephrosia Vogelii* and *Crotalaria usaramoensis*) were sown and harvested at intervals of 3 months for the 2 years during which the observation plots were under trial. Yields of compost from these semi-cultivated covers were approximately 20 tons per acre per annum, and the cost of production of compost (under the very atypical and expensive system of an Agricultural Station) worked out at about $8 per ton in 1940.

From these yields it appears that 40 tons of compost per acre per crop, or approximately 120 tons per acre per annum, would require about 6 acres of bushy cover crop for production. This is to say the ratio of land under cash-crop to land producing compost is 1 : 6. This, in fact, corresponds fairly closely to the proportion of the average holding which at any one time is under cultivation. As stated previously, the normal holding of 2 or 3 acres has less than ½ acre under actual cash-crop.

Under the present system, the gardener expends, at current prices, sums which may approach $4,000 per acre per crop on prawn and fish waste, while he has available the necessary reserve of land on which to grow the vegetable matter required for compost. By employing his wasted, or fallow,

land for this purpose, he would be saving this great expenditure on purchased fertilizer. Comparatively, his compost becomes worth approximately the price of the prawn waste which is at present about $340 per ton. As previously stated, the 1940 cost of growing and making compost under the expensive conditions of an Agricultural Station was about $8 per ton. Or, reverting to a former contention, the gardener is, in effect, purchasing his prawn and fish waste primarily for its value as organic matter necessary for the maintenance of the texture and biological condition of his soil, and is paying a grossly excessive price for what he could himself produce easily and cheaply.

Therefore, as a means towards self-sufficiency and as a valuable step towards efficiently meeting, on economic grounds, the anticipated competition of imported temperate-climate vegetables which is sure to come again, it is suggested that there should be a marked change in traditional Chinese methods as applied to vegetable production in Cameron Highlands. Instead of purchasing at great expense (and cost must always be high because of transport) bulky forms of organic nitrogen, the gardener should devote some of his attention to the growing of vegetable matter on the portion of his holding not actually under vegetables grown for sale, and he should turn this in green on the land under crop, or convert it to compost with the aid of pig-dung according to the specific requirements of the particular crop being grown.

The regular removal of green matter from the portion of the holding not under crop results in gradual diminution of its fertility. Experimental evidence at the Agricultural Station shows two apparently satisfactory methods of meeting this loss. The one is by a movement of the area under cash crop to an area formerly under a cover-crop or rough vegetation, and a sowing of the former cash-crop area to leguminous covers such as *Tephrosia* or *Crotalaria*. These crop heavily on recently cultivated land, and the green matter thus produced can be utilised to enrich the area newly brought under vegetables. This miniature form of shifting cultivation appears satisfactory and is simple in operation where a holding has a sufficiency of suitable level land. The alternative method which has also proved successful is the manuring of the cover crop or other vegetation with economically small dressings of pig-dung and phosphates, and the permanent retention of the cash-crop area as such. This system is suited to holdings which have a considerable area of steep land and only limited ground level enough for vegetable cultivation without risk of erosion. Such holdings are locally in the majority.

In putting forward these suggestions it is assumed that the majority of permanent vegetable-gardeners keep pigs, the natural and general complement to the production of vegetables. With a few pigs on the holding, the production of compost is greatly facilitated, and the possibility of any serious depletion of mineral matter is minimized, provided a reasonable

balance is maintained between the number of pigs kept and the size of the holding.

It should perhaps be added that at the Agricultural Station some of the heaviest crops and the best in quality in the district are continually produced. Apart from very small quantities of rock phosphates used on a few beds for specific crops, no purchased fertilizers have been used since the re-occupation, nor does there appear any need for them in the presence of the Station's herd of pigs.

Summary.

1. A general review of the production of temperate-climate vegetables in Cameron Highlands is given.
2. A criticism of traditional Chinese methods of vegetable growing, as brought into a totally different environment, is made.
3. Results of observation plots of vegetables treated with compost, with various dressings of inorganic fertilizers, and without, are summarized.
4. It is suggested that the traditional methods, as imported to a different environment, are uneconomic, and that experimental evidence suggests that it would be profitable for vegetable gardeners in this district to devote the major portion of their holdings to the production of vegetable matter for use as fertilizer, either composted or possibly as green manure.
5. Such a change of method is advocated on economic grounds in view of the probability of competition with imports.

Received for publication, 21st November, 1946.

A BRIEF REVIEW OF ESSENTIAL FOODCROP CULTIVATION IN MALAYA

BY

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Acting Agricultural Economist.

Such intensive efforts have been directed to the "Grow More Food" campaign and so much has been written in the local press on Malaya's food supplies, that it is desirable in this first issue of *The Malayan Agricultural Journal* since the liberation to give a brief review of the situation.

Rice.—Prior to the war Malaya produced slightly more than one third of her total rice requirements. In 1940 locally grown rice amounted to 335,000 tons, or 35 per cent. of that year's consumption. Complete figures for 1941 are not available, but the total area under padi in the 1940-41 season was 820,480 acres, of which 77,880 acres were under dry padi, giving a yield of 324,000 tons of rice.

Table I shows areas planted with wet and dry padi in the 1945-46 season together with yields. It will be seen that while the planted area of 789,640 acres had fallen by less than 4 per cent., the yield of rice, 225,000 tons, showed a decrease of nearly 31 per cent. Several factors were responsible for this reduced yield. Planting was carried out just before and after the liberation with the result that the same adherance to planting dates would not be observed as in former years. Irrigation systems had suffered serious neglect during the period of the occupation so that padi growing on land with a water supply provided normally by such systems made poor growth due to lack of adequate water. Before the war, high-yielding strains of padi, the result of long years of research work by the Department of Agriculture were used for seed, particular varieties being grown in those parts of the country for which they had been found most suitable. During the occupation the results of this work were largely lost; the Japanese were more interested in their efforts to introduce their own varieties of padi than in the maintenance of established pure strains. They wished to show that they could achieve in one season better results than years of patient experimentation had contrived to do. A considerable loss of high-yielding padi seed resulted, pure strains were mixed and lower yields have been harvested. In addition, the Japanese introduction, Taiwan padi which failed to yield two satisfactory crops per year, brought with it Padi Blast which is a very serious disease in other padi growing countries. By eliminating the planting of the Japanese variety it would seem, from reports on the present crop, that the disease has successfully been brought under control, and little damage from it is expected. Another important factor affecting the crop harvested was the serious depredations by wild pig,

Table I.

Area of Land Planted in Malaya and Yields of Padi. Season 1945-1946.

State	WET			DRY			TOTAL	
	Acres	Gantangs	Average	Acres	Gantangs	Average	Acres	Gantangs
Perak ..	100,730	18,099,000	180	33,550	2,140,000	64	134,280	20,239,000
Selangor ..	33,720	7,569,800	224	4,790	336,300	70	38,510	7,906,100
Negri Sembilan ..	27,691	3,105,550	112	951	34,650	36	28,642	3,140,200
Pahang ..	42,740	5,739,000	134	5,130	311,500	61	47,870	6,050,500
Province Wellesley & Penang ..	36,489	8,063,794	221	—	—	—	36,489	8,063,794
Malacca ..	30,602	4,984,320	163	—	—	—	30,602	4,984,320
Johore ..	16,290	1,133,825	70	14,196	376,080	26	30,486	1,509,905
Kedah ..	213,830	62,954,000	294	5,317	345,000	65	219,147	63,299,000
Kelantan ..	119,531	19,897,051	166	29,777	2,040,080	68	149,308	21,937,131
Perlis ..	35,707	7,532,498	211	204	16,488	81	35,911	7,548,986
Trengganu ..	26,675	4,224,200	158	11,720	976,500	83	38,395	5,200,700
Total ..	684,005	143,303,038	210	105,635	6,576,598	62	789,640	149,879,636

149,879,636 gantangs of padi = 225,044 tons of rice (Conversion 666 gantangs padi = 1 ton rice).

squirrels and rats, pests which had increased enormously during the years of occupation. An intensive rat campaign has already reduced the damage caused by this pest to modest proportions, but such control measures did not have their full effect during the 1945-46 season.

The present season offers a better picture. At the time of writing this review, planting has not yet been completed throughout the country, but it can safely be estimated that the total area of padi will be approximately 837,000 acres, of which approximately 100,000 acres will be dry padi. It is still too early to give an accurate forecast of the crop that can be expected, but careful consideration of past yields suggests that a conservative estimate would be of the order of 275,000 tons, while it is quite possible that this figure may be exceeded. The severe drought at the commencement of the season inevitably had its effect on the newly planted nurseries and early transplanted seedlings, but padi planters throughout the Peninsula made valiant efforts to offset this initial setback.

Essential Foodcrops.—Table II provides a comparison between areas under essential foodcrops at the end of 1940, at the end of 1945, and at 30th June and 30th September 1946. Figures for December, 1946, are not yet available.

This table shows that the total area of foodcrops at the end of the 3rd quarter, 1946, was approximately 272,000 acres as compared with 215,700 acres at the end of 1940.

It will be seen that acreages at the end of 1945 were very high, due to the extensive planting of tapioca and sweet potato during the occupation. It is possible, however, that these figures may not be accurate. There was a tendency to show increased planting during the occupation, and during the first months after the liberation it was not possible to ensure that all such records were verified. Since the end of 1945 there has been substantial harvesting of tapioca, sweet potato, maize and ragi, without comparable replanting, bringing about a big reduction in the areas under these crops, although they show an increase over the 1940 figures. It must be remembered, also, that during the Japanese occupation there was a considerable exodus from the towns into the country; jungle was cleared and new foodcrop areas were developed under compulsion. With the return of the British, people flowed back into the towns, and newly-cleared areas, after having been cropped, were abandoned. Thus inevitably a reduction in foodcrop acreages occurred with the return of more profitable employment in the towns and the cessation of cultivation under compulsion.

Other factors affecting foodcrop cultivation to a considerable extent are: (a) the revival of the rubber industry, resulting in the small-holder transferring his attention to the more profitable tapping of his rubber trees, (b) padi cultivation leaving less time for work on other crops and also taking up padi land which had been planted with foodcrops during the off-season, and (c) the serious damage caused by wild pig. It is inevitable that the small farmer seeing his crops destroyed by pig is unwilling to

Table II.

Malayan Union

Comparative Table of Areas under Essential Foodcrop Cultivation.

Crop	1940 31st Dec.	1945 31st Dec.	1946		
			30th June	30th Sept.	Estate Cultivation
	acres	acres	acres	acres	acres
Tapioca ..	46,292	157,100	83,211	73,589	4,308
Sweet Potato ..	12,366	78,318	35,775	28,007	827
Sago ..	6,976	6,813	6,273	6,283	—
Sugar Cane ..	3,251	10,140	10,370	10,345	—
Groundnuts ..	2,054	5,166	4,131	3,388	96
Maize ..	8,369	17,968	6,130	5,496	2,357
Yams ..	1,859	3,252	2,009	2,008	5
Colocasia ..	2,938	10,800	6,108	5,538	—
Ragi ..	181	23,410	2,956	1,553	1,319
Soya Beans ..	188	652	678	480	—
Pulses ..	—	—	1,208	968	131
Market Gardens (Vegetables) ..	25,406	35,619	21,141	19,397	3,454
Pineapples ..	60,157	25,609	11,705	11,481	—
Bananas ..	45,728	83,352	73,552	71,029	150
Mixed Crops ..	—	—	—	50	4,308
Pumpkins ..	—	—	89	—	—
					15,269*
Total ..	215,765	458,199	265,336	239,612	32,224

* Details not available.

Table III.

Estate Production of Palm Oil and Kernels, May to December, 1946.

STATE	PALM OIL			KERNELS		
	December	Total May to December	Total for year	December	Total August to December	Total for year
Perak ..	896.9	4,663.5	4,663.5	115.6	215.5	215.5
Selangor ..	329.6	1,386.8	1,386.8	21.5	44.2	44.2
N. Sembilan ..	24.0	177.5	177.5	—	—	—
Pahang ..	55.2	207.1	207.1	—	—	—
Johore ..	1,244.6	5,321.5	5,321.5	245.2	671.9	671.9
Kelantan ..	—	—	—	—	—	—
Total ..	2,550.3	11,756.4	11,756.4	382.3	931.6	931.6
1940 ..	3,918.3	41,754.4	57,972.1	565.6	3,540.9	9,611.2
1939 ..	5,195.6	39,336.6	57,372.7	946.8	4,830.4	10,172.4

Note:—In December 31 estates (planted acreage 69,380.2 acres) were in production out of a total of 46 oil palm estates (planted acreage 77,457.9 acres).

continue their cultivation and risk further loss. Continuous efforts have been made since the end of 1945 to obtain adequate supplies of shot guns and ammunition, but only limited quantities of ammunition have been received. Nevertheless, in spite of all these adverse factors and difficulties substantial areas of land are maintained under foodcrop cultivation, and acreages under tapioca, sweet potato, colocasia, sugar-cane, ragi and banana show a satisfactory increase over the 1940 figures.

The big reduction in the area under pineapple is due to the loss of the large acreage in Johore which formerly supplied fruit for the important pineapple canning industry of Malaya. These areas were neglected during the Japanese occupation; fruits were harvested and the land allowed to revert to secondary jungle growth. New areas have already been opened up and planted, but some considerable time must elapse before the large pre-war acreages are reached.

By a Proclamation in 1946 all estates were required to plant a minimum of 2 per cent. of their acreage with foodcrops. Complete returns are not yet available but from Table II it will be seen that at the end of the 3rd quarter, 1946, the total area of such cultivation was over 32,000 acres, representing a valuable addition to Malaya's food resources.

Oil Palm.—Palm oil production, being primarily for export, does not properly come within the scope of this review, but it is felt that the following particulars of the present position will be of general interest.

Table III shows production of palm oil and kernels since May, 1946, together with comparative figures for 1939 and 1940. Factories suffered serious loss of machinery as a result of the invasion but rapid progress has been made in most cases with rehabilitation, and 31 estates, representing approximately 69,000 acres, are now in production, as compared with 46 estates with a total of over 78,000 acres in 1941.

Received for publication, 6th December, 1946.

INTENSIVE GARDENING IN A P.O.W. CAMP

BY

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The Need for Green Vegetables.

As the rations of the prisoners of war slowly and steadily deteriorated, the need for growing additional vegetables to supplement the meagre rations became increasingly obvious, and it was not long before small garden plots were being cultivated by a few individual enthusiasts on behalf of the units to which they belonged.

Frequent changes of quarters, indifference and lack of support, successive alterations in camp boundaries, the arrival and departure of fresh drafts, the general feeling of unsettlement arising from unquenchable optimism, and, in general, a lack of knowledge of the requirements of tropical gardening and a lack of appreciation of the deficiences of a diet based on polished rice, were the principal factors which operated against the full success of these early efforts.

A wide range of products was cultivated. Many, yielding inadequate crops, though providing pleasant adjuncts to an unattractive diet, were most generally grown, and the supreme importance of concentrating on the high vitamin-bearing green-leaf vegetables was appreciated only by the few. Instead, tasty calorie-yielding tubers such as artichokes and sweet potatoes, watery gourds such as cucumbers and pumpkins, attractive foods such as tomatoes and ladies' fingers, and the more difficult crops, maize and groundnuts, herbs and spices, were mostly grown.

Only the more knowledgeable and long-sighted, in those early days, appreciated the urgent need for leaf vegetables such as spinah, *Basella rubra*, amaranth, *Amaranthus gangeticus*, and kangkong, *Ipomoea reptans*, and the leaves of tapioca and sweet potato and of the privet-like shrub "chekur manis", *Sauropus androgynus*. While these are of little use in supplying calories, they are rich in essential vitamins, particularly those belonging to the vitamin B complex.

The situation steadily deteriorated and culminated in serious outbreaks of beri-beri and riboflavinosis, characterized by sore mouths, intestinal disturbances, and severe scrotal dermatitis. Finally the Camp Adminstration decided to appoint a dietician to calculate and adjust the rations so as to provide a properly balanced diet. This task was allotted to Major J. Burgess, F.M.S.V.F., a member of the Malayan Medical Service, and at the same time, Captain A. de K. Frampton, S.S.V.F., of the Department of Agriculture, was placed in charge of camp gardens.

So long as supplies were available, the host of diseases covered by the term 'avitaminosis' was thereafter kept under partial control by vegetables produced in the gardens, and the bulk purchase of groundnuts, tauge (sprouted beans), soya beans, and rice polishings from outside, but, by the end of 1943, these commodities were no longer available and a further severe outbreak of deficiency diseases once more occurred.

The production of leaf vegetables was accordingly stepped up, and the Camp Administration issued a general order for every scrap of land within the encircling wire to be cultivated under unit arrangements. Subsequently the need for producing calorie-bearing foods became of almost equal importance, as food supplies from outside continued to diminish.

By September, 1944, the original ration of 50 gm. leaf vegetables per man per day had been raised to 180 gm. and a peak of 300 gm. was finally reached in November. Thereafter, production remained at about this figure for the remaining period of imprisonment.

The new outbreak of disease, which started in May, 1944, continued until October, when, as a result of the extra intake of green vegetables, there was a sudden decrease in the number of fresh cases, and thereafter these deficiency diseases ceased to be of major importance as a cause of ill-health.

The Fly Menace.

During 1944-45, the prisoners, in numbers varying between four and twelve thousands, were closely concentrated inside and around the walls of Changi gaol, and there was not very much land available for cultivation. The soil, too, was so very poor that the order to cultivate would have been quite ineffective without the application of some form of manure. The gardeners, in desperation, were quite prepared to dig-in human excreta, poultry droppings, raw kitchen waste, and lalang *Imperata arundinacea* (a coarse tall grass), and in fact did so. The Camp Hygiene Officer, Major C. Gunther, A.I.F., naturally objected, and a compromise was reached by the appointment of a Camp Compost Officer, whose first duty was the prevention of unhygienic practices, and whose second duty was to organize the production of compost at various centres under controlled conditions.

It is well known that flies are attracted by rotting material and lay their eggs the moment they alight. Furthermore, the sub-soil provides a perfect medium for fly-breeding, so that, when infected waste is buried, the eggs hatch out; there is ample food and it is cool, dark and moist, and the resulting larvae can move freely up through the loose earth to the surface to pupate and take to flight.

The danger of allowing flies to breed in this way could not be too strongly emphasised in view of the congested conditions, the large number of dysentry carriers, the ever-present risk of cholera, and the low state of health of everybody in the camp.

The Production of Compost Without Flies.

The soils round the gaol ranged from fine loose sand to a yellow lateritic loam with underlying clay. They appeared to have been subjected to soil erosion as they were devoid of humus and appeared to be quite infertile. The sandy soils were too dry, and the loams too hard and compact, to allow the free growth of roots. The problem was to provide sufficient soil nutrients, to improve the soil texture, and to increase its moisture-carrying capacity. There was only one answer: compost must be produced without flies.

To achieve this it was necessary to exercise the strictest supervision over the camp kitchens and poultry runs, and to make certain departures from normal practice in composting. The poultry runs were brushed out and inspected every day; sour food was disposed of down a lidded borehole; and poultry droppings and run sweepings were carefully collected in lidded bins. Similarly, at the kitchens there was scrupulous cleanliness, and the kitchen waste was sorted into covered bins labelled "Rice", "Ashes", "Rubbish", "Wet Waste", "Dry Waste", and "Tea Leaves." The various bins were collected twice daily and delivered to the compost centres, and there disposed of without delay.

At the compost depots equal care was taken to prevent flies breeding in the fouled ground around the compost heaps. The siting of these depots took into consideration the fact that kitchen waste is on average, twice as heavy, and over ten times as bulky, as the derived compost, and that water is required in considerable quantities. It was not possible to locate them more than a few yards from any of the huts, and the offensive smells had to be endured. They were all situated on gently-sloping ground to allow sour liquors to drain away from the base of the heaps, and so prevent the ground around the heaps from becoming a quagmire. The ground was raked clean each day, and any fouled ground, e.g. the site of an old heap, was sprinkled with wood ashes, and covered with 1 ft. of dry lalang until a fresh heap was started there.

The composting process was basically the same as that described in Agricultural Leaflet, No. 6, "Composting", published by the Department of Agriculture, but with certain important modifications to ensure the absence of fly-breeding in the heaps, in view of the fact that all of the depots were so close to the kitchens and huts, and well within the range of flight of the house-fly.

The following points were taken into consideration in evolving the special method practised in the camp:—

1. The life cycle of the house-fly from the egg to free flight is approximately ten days, varying with the conditions.

2. The eggs are destroyed in the hottest part of a compost heap, but not in the cold outer shell. Here the eggs will hatch out, and when the conditions become too uncomfortable, the resulting larvae will wriggle through the material to the surface to pupate.

3. The range of flight of the flies which result is well over half a mile.

4. Fly larvae can also pass freely through soil in order to reach the surface, prior to free flight.

5. Neither flies nor their larvae will attempt to penetrate a bed of loose dry lalang.

The heaps were accordingly all built up from ground level, without excavating the usual shallow pit, so that larvae could not escape into the soil from the base of the heaps. Each heap was turned within 10 days of laying down the first lot of vegetable waste, and thrice more at 10-day intervals. Most important of all, each heap was provided with a jacket of lalang, consisting of four walls and a roof, 1 foot thick. This shell was carefully built-up to receive each additional charge of waste, and was not wetted or composted.

Thus the shell was quite independent of the material being composted, and so could be carefully peeled off. It was opened each day while a heap was being made up to allow fresh additions to the core, after which it was again sealed. Similarly, when the heap was being turned, the cold shell was first removed entirely before the hot core was broken-up. Meanwhile, three new walls of lalang were started to receive the reconstructed heap, which, when finished, was once again sealed with lalang.

This jacket of lalang served to prevent flies from laying any more eggs among the decomposing rubbish, making them keep their larvae inside the heap, and so ensure their destruction. It also acted as a thatched roof, and so afforded protection against rain, while on cold nights it retained the heat. Furthermore, it allowed free aeration, so that foul gases could escape from the heap and be replaced by fresh air.

It is essential to be able to distinguish between the larvae of the fruit-fly which is harmless from a hygienic point of view and those of the house-fly, because fruit-fly larvae are usually to be found in the finished compost in considerable numbers. This is owing to the fact that they seek warm conditions, may remain inactive and dormant for long periods, and are not easily destroyed by heat. The larvae of the two are similar, but whereas the fruit-fly larvae are round at one end and pointed at the other, the house-fly larvae are round at both ends. The former have scarcely any visible markings or corrugations, whereas house-fly larvae are ribbed like Michelin men. Fruit-fly larvae have a jumping habit, and when exposed to light, will roll themselves up, spring open suddenly and so shoot themselves considerable distances in their efforts to escape. It is considered that these heat-resisting larvae were useful in effecting additional aeration of the compost heaps.

Grubs of the Rhinoceros or coconut beetle would often be found in the cold sodden ground round the base of, but not underneath, the heaps. The beetles attack coconut palms, so the grubs were collected and fed to poultry.

The Manufacture of Compost.

The standard procedure was to build up the heap by daily additions for 9 days, turn it on the tenth, twentieth, and thirtieth day, and issue it after 45 days. On the first turning, the material was very raw, sour, and evil-smelling, and the work was very heavy; on the next occasion, the material was still stringy and difficult to handle; on the last, the compost was almost ready, but not quite uniform in texture; and finally, when issued, it was dark-brown, friable, and fibreless, possessed a pleasant earthy smell, and was no longer of much interest to flies.

Forty-five days is exactly half the time required by the standard process, and the explanation of this much more speedy production would appear to be that the cold outer shell of lalang which constitutes about one-half of the heap, is not composted, whereas, in the ordinary way, the cold shell and the hot core are mixed every time a heap is turned.

Except for cattle manure, normally required to inoculate the heaps and reduce the C/N ratio, materials were in plentiful supply. The most important ingredient was undoubtedly human urine. Only a little was required for composting; the remainder was used for watering the gardens, after dilution with water in the ratio of 1:4. It was fortunate that although flies are attracted by the smell of urinals, they do not lay their eggs there, and when urine is diluted it ceases to attract flies. In composting, urine was added with a slurry of wood ash after each fresh charge of kitchen waste, and it was also sprinkled in the form of urinated earth over layers of very soft, wet material.

Another ingredient of almost equal importance was wood ash, obtained from unit kitchens, where rubber wood was used as fuel. Unfortunately, it was necessary to reserve the whole of the available supply for soap-making during the final year, and it became necessary to collect and burn coconut fronds, husks, shells, twigs and roots to remedy the deficiency. Though it was found possible to make compost without ash by substituting urinated earth, decomposition was slower. Besides acting as an anti-acid and deodorant, wood ash is rich in the essential mineral, potash.

The vegetable waste which was composted ranged from fruit skins, vegetable peelings, and rotten fruit to drier material such as leaves, stalks, vines, garden weeds, and lalang. Rotten fruit and vegetables, and the juicy trunk of the banana needed to be chopped and crushed in order to accelerate decomposition, and pineapple skins, which are difficult to compost, were successfully reduced in contact with drier material by the liberal use of wood ash. Woody and resistant matter, such as coconut husks, shell and roots, twigs and rotting wood, were omitted as these require much longer treatment. It is perhaps hardly necessary to add that spoiled rice and cooking pot scrapings were fed to poultry. In any case, rice breaks down completely to water and gas, and merely increases the difficulties of composting.

By careful sorting of all waste into appropriate bins, as previously described, it was possible to arrange a proper sequence of wet and dry, hard and soft, open and close-textured material. Close material, such as tea leaves and fresh grass clippings which tend to seal a heap were evenly sprinkled in thin layers in the same way as the droppings from the poultry runs and rabbit hutches.

The temperatures attained within the heaps were a measure of the micro-biological activity. Wooden testing rods were used to prove the heaps. If they emerged cold and wet, either the reaction had not started or there was too much moisture; if only slightly warm, dry, and shewing traces of white mould, the heap needed more moisture; and if the conditions were just right, the stick emerged hot, moist, and stained dark-brown. Conversely, if the stick was free from slime and rank smell, and could be pushed back easily, the compost was ready to be used, but if there was any resistance, the material was not ready.

The addition of urinated water was a matter of judgment and experience. It was usually added each day after the final layer of waste had been liberally sprinkled with ash, the amount depending on the quantity of succulent material present, care being taken not to add too much and not to wet the lalang walls. The heaps were usually watered again on turning if visible white mycelial strands of fungi indicated an insufficiency of moisture.

Compost Production and Application.

The inner gardens, made up of a vast number of small plots, totalled about 12 acres, being divided into four groups, each with a composting depot.

In fourteen months, the total production of compost by one group amounted to 132 tons which, applied to 3 acres, was equivalent to an application of 2 lbs. per square foot. In addition, a considerable quantity of diluted urine was also added to the soil, in the form of twice-daily waterings. It is estimated that out of an annual production of urine of about 500 tons, about 300 tons was applied to the soil in this way; only about 10 tons were required to make compost, and the remainder was wasted.

It is further estimated that in addition to this quantity of urine, about 200 tons of kitchen waste, 50 tons of lalang, 4 tons of wood ash, and 8 tons of poultry droppings were required to produce this 132 tons of compost, estimated on the basis of 64 lbs. per cubic foot. The total yield of vegetables was 144 tons, estimated on the basis of the yield from a measured area of ¾ acre, which was at the rate of 48 tons per acre.

In brief, 2 tons of raw materials produced 1 ton of compost, which together with 2 tons of urine yielded 1 ton of vegetables. This leads one to the question of cost of production. In a prison camp this was to be measured in terms of man-hours of work, and the itemised account for the group referred to above was as follows:—

	Labour per week
Collection of bins	35 man-hours
Cutting and collection of lalang ..	10 ,, ,,
Building compost heaps	5 ,, ,,
Turning the heaps	36 ,, ,,
Delivery of compost to the gardens ..	3 ,, ,,
Total ..	89 ,, ,,

Thus, in 14 months, 5,400 man-hours of labour were required to produce 132 tons of compost without which it would have been quite impossible to obtain 144 tons of extra vegetables for 1,200 men.

The compost was not applied heavily to a piece of ground in a single application, but was spread thinly and evenly over the ground, and confined to the top spit of soil by shallow digging so as to bring the whole of the land into effective cultivation as quickly as possible. In the course of a year, the land was manured four times, on each occasion just prior to replanting. This system of gradual incorporation was found to be much more effective than a single heavy application.

As the needs of the camp became more urgent, the gardeners concentrated on the very high-yielding green amaranth and tapioca, and for many months the diet of the prisoners consisted of " greens ", rice and tapioca root, variously made-up and flavoured with sugar, sea-water, garlic, chillies, pepper, or curry powder, and with a trace of odoriferous " blachan " (shrimp paste), dried fish, or palm oil.

The amaranth was not harvested young and tender as a two weeks old seedling, as is the usual custom, but was left in order to obtain the maximum yield, as the leaves become larger and coarser as the plant matures. The plant was trimmed once every three weeks, four crops being taken in all, before the plant reached the seeding stage and had to be pulled up.

It was found that the peeled stalk was edible, and could be eaten as " asparagus ", incorporated in soup, or used as pulp for " jam ". In this way, about 75 per cent. of this plant was consumable, the remainder going back to compost. Ceylon spinach was only 50 per cent. consumable, because the vines are inedible, and furthermore the crop of leaf was much smaller, and the plant required a longer period to reach full development.

It was found that amaranth was a useful indicator of soil conditions. Without compost, the crop succeeding the first weedy harvest was a failure. The surviving plants were stunted, irregular and unhealthy, and only between 12 and 18 inches in height. With successive dressings of compost, five successive plantings on the same piece of land became steadily healthier and more productive, even though there was no crop rotation or resting of the soil. The last crop, collected just before release, consisted of plants between 5 and 6 ft. in height, with large leaves and sturdy trunks, and a

2 ft. root system, as compared with the 9 inch root system of the initial crop on uncomposted soil. It almost appeared as if it were possible to go on planting this crop indefinitely. Urine alone, added without compost, did not give satisfactory results as only a quarter of the crop was obtained.

While a single analysis does not provide conclusive evidence of the effect of composting, nor does it indicate the physical changes in the texture of the soil, nevertheless the result of a comparative analysis of two samples of soil is submitted. These samples were examined in the laboratories of the Department of Agriculture, Ceylon, shortly after the conclusion of hostilities.

Soil Type	Two immediately adjacent soils	
	(a) Untreated Yellow lateritic loam per cent.	(b) Treated Grey-brown lateritic loam per cent.
Stones and gravel ..	3.84	1.85
Reaction (pH) ..	4.8 (acid)	5.8 (slightly acid)
Carbon (Walkley) ..	0.417	1.29
Nitrogen ..	0.027	0.076
C/N ratio ..	15.4	17.0

The treated soil had received five successive plantings of amaranth, without resting; the untreated soil had not been cultivated at all.

Summary.

It has been shown that:—

1. An infertile and unproductive soil can be made to give high yields of "greens" by incorporating compost made from kitchen waste.
2. Compost can be produced in 45 days in the tropics by covering the heaps with a jacket of lalang.
3. It can also be produced without flies, and at a cost of 40 man-hours per ton.

Received for publication, 14th December, 1946.

Selected Articles.

IMPROVISED BIOCHEMICAL WORK OF A PRISONER OF WAR*

The Author was taken in Singapore as a military prisoner of war by the Japanese in February, 1942. He was later sent to Thailand on the construction of the Burma-Thailand railway. Towards the middle of 1944 circumstances brought him to the recently-constructed base hospital camp at Nakom Patom, about 60 kilometres west of Bangkok. The camp was full of patients, contained a good number of doctors, had a limited supply of drugs and medical equipment but no biochemical apparatus.

The following account of biochemical work carried out under prisoner-of-war conditions has been written in the belief that the circumstances under which, and the methods by which, the results were obtained may be of interest.

During my stay in Nakom Patom camp from June, 1944, until March, 1945, I was given the opportunity of carrying out certain biochemical work in conjunction with the medical staff of the camp. The following is a brief account of the type of work carried out and of the difficulties encountered. The first part deals with gastric analyses and the second with renal efficiency tests, but the two lines of investigation were carried out concurrently.

At the start of the investigations there was practically no apparatus and very few chemicals. The apparatus required had to be constructed from any available local materials; the most useful source was the blood transfusion sets which had been sent into the camp. The bottles from these sets were cut in half, the bottoms being used as flasks or beakers and the tops as filter funnels. The rubber caps were bored with red-hot nails and used as bungs and corks. A supply of rubber tubing was also obtained from these sets.

Empty ampoules of distilled water were cut and trimmed to serve as test tubes and boiling tubes. There was available a small amount of glass tubing of assorted sizes, in about three-foot lengths, and a few sheets of filter paper. The only balance in the camp was an old pair of dispenser's scales accurate to about 0.2 gm. There was no running water. The only sources of heat were open wood fires, charcoal braziers, or a small spirit burner. At the time of my arrival a rice fermentation process had been started which produced a fair yield of ethyl alcohol, which, by distillation, was concentrated to a strength of between 80-90 per cent. A modified fermentation process was giving small yields of a weak acetic acid solution of about 4 per cent.

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* By R. G. H. Wilshaw, Acting Chief Research Officer, Department of Agriculture, Malaya. *The Pharmaceutical Journal*, August 24, 1946.

Gastric Analyses

The first work to do was to devise a method of carrying out gastric analyses. It was decided by the doctors that the most suitable test meal under the prevailing circumstances was 100 mils of 7 per cent. alcohol. This presented no difficulty. The tube to obtain gastric contents was the rubber tubing from the blood transfusion sets; it was of narrow bore and worked admirably. During the course of five months I passed tubes on over 200 patients without any difficulty or failures.

Since a suitable stomach-tube was available and also a suitable test meal, the problem became a matter of glassware and chemicals. To carry out any volumetric work some graduated glassware was necessary. A number of hypodermic syringes were available in sizes from 1 mil to 20 mils. With the aid of these and glass tubing a number of graduated burettes and pipettes were made. The graduations, which were scratched gently on the surface of the glass, agreed well with the theoretical measurements calculated from the internal bore of the tubing. All the apparatus was graduated " to deliver ", and by the use of a metal " T " piece a successful automatic 5-mil burette was made.

The chemicals required were a standard alkali and acid, and a suitable indicator. At this period there were no strong acids available; the only alkali was sodium bicarbonate, which, by ignition, could be turned into the carbonate, from which a N/10 solution was made up. With this solution, provided a suitable indicator could be found, titration for total acidity of gastric contents could be carried out. On searching through some chemicals a small bottle of Alophen was discovered; this was known to contain a phenolphthalein. On making up a 1 per cent. solution in alcohol and testing it as an indicator, it was found that the phenolphthalein complex was too slow in breaking up and liberating the coloured ion in alkaline solution for it to be used in the normal manner. It was found, however, that by adding the indicator to the alkaline solution and allowing it to stand, the full red colour then slowly developed. Once this had occurred the titration could be carried out by using the coloured alkali and titrating to the first appearance of colour in the acid solution.

The titration of gastric secretions with sodium carbonate and this indicator was not, however, completely satisfactory, because the presence of CO_2 interfered with the end point. Boiling the solution to eliminate the gas merely caused a partial breakdown of gastric proteins with the production of amino-acids; the latter caused further interference. However, this method was used as a start. A short while after, a bag of slaked lime was discovered, and a bottle of concentrated hydrochloric acid was obtained from Bangkok. This was a great advance, as a standard volumetric solution for all work could now be made by suitable dilution of the concentrated acid. For this purpose the concentrated acid was taken as being 10N, and the solution obtained by diluting it 100 times was taken as standard N/10 solution for all subsequent work. A saturated solution of the lime

was used as standard alkali. The solution was allowed to stand at all times in contact with excess of the solid, and was titrated and standardised whenever necessary before use. It was found that at the even temperature in Thailand, the solution maintained an approximate strength of N/30.

It was considered desirable to determine the free acidity of the gastric secretions. This could only be done if an indicator with a colour change at about pH 3 could be found. Such an indicator was subsequently obtained by making an alcoholic extract of a plant that grew locally; its discovery, referred to later under the determination of blood urea, enabled free acidities to be determined. With standard acid and alkali and suitable indicators no further difficulties were encountered in carrying out the gastric analyses.

Peptic activity of the secretions was estimated by determining the time required for them to dissolve a small piece of coagulated egg-white of standard size. The size was that of a section of a cylinder about 2 mm. diameter and 2 mm. long. The pieces were cut out of the egg-white by means of a small metal cutter shaped like a cork borer. It was found that a " normal " secretion would dissolve the protein in about three hours; in cases of hyperchlorhydria the action took considerably less time; in cases of hypochlorhydria often longer, and in cases of achlorhydria, no solution took place on standing overnight.

The general procedure was for the patient to present himself for examination first thing in the morning, after only a light rice meal the previous evening. A tube was passed and the resting contents of the stomach removed by means of a 20-mil syringe attached to the end of the tube. When the stomach was empty, the patient was given 100 mils of 7 per cent. alcohol to drink and allowed to sit with the tube *in situ* for half-an-hour. At the end of this time the total stomach contents were again removed.

Total and Free Acidity

As soon as the resting contents were obtained, observations were made on the volume, colour, odour, and mucoid nature, the presence or absence of food particles, bile and blood. They were then filtered through cotton-wool the mucus-free runnings titrated against standard N/30 alkali, first, for free acidity, and then for total acidity. A small quantity was then set aside for determination of peptic activity. Similar observations and determinations were made on the contents obtained after the test meal. In general it was found that the values for total and free acidity differed by 10-20 mils of N/10 per cent. The normal range of free acidity was taken as extending from 20 mils to 60 mils N/10 per cent. after the test meal. Higher values were returned as cases of hyperchlorhydria, and lower values as hypochlorhydria or achlorhydria from the peptic activity shown.

In view of the acute shortage of acid in the camp, a convenient and successful method of treatment of cases of achlorhydria and hypochlorhydria was found to be the administration of the filtered gastric secretions obtained

from patients suffering from hyperchlorhydria. These secretions were also used at one time with a moderate degree of success as a soldering flux. During the course of the work a few cases of stasis were encountered and surgery subsequently confirmed two cases of " leather bottle " stomach and one case of carcinoma.

Renal Efficiency Tests

Towards the end of 1944 investigations were commenced on the possibilities of carrying out a renal efficiency test. This required the determination of blood and urine urea and the calculation of the rate of blood clearance or a Van Slyke index.

Hydrochloric acid and calcium hydroxide were available; there was plentiful local supply of soya beans. These circumstances practically dictated the use of the urease-titration method for the determination of urea. In this method blood urea is changed by the enzyme, urease (contained in soya bean) into ammonium salts. On alkalinising the blood solution the ammonium salts can be volatilised off and absorbed in standard acid. By back titration of the acid, the amount of ammonium salts can be calculated, and hence the urea.

There was little difficulty in fitting up the extremely simple glass apparatus required for this method. It consisted in its elements of three inter-connected boiling tubes. The first contained acid; it acted as a trap to remove any ammonia from the air as it was aspirated. The second tube was the reaction tube; it was surrounded by a warm water bath, in which the urease acted upon the blood urea. The third was the absorption tube in which the ammonia displaced from the second tube was absorbed by standard acid.

An Improvised Suction Pump

Two obvious difficulties were first to devise some satisfactory method of aeration, and second to find an indicator which was suitable for titrating the acid in the presence of ammonium salts. A third difficulty, which arose in practice, was to find some means of preventing the frothing of the blood solution under aeration. To overcome the first difficulty, an attempt was made to suck air through the solutions by means of a controlled flow of water dropping from a container; it was found that the maximum flow of air obtainable, consistent with the practical difficulty of constantly filling a small container with water, was insufficient to remove all the ammonia from the blood solution. In the end, a mechanic constructed a small hand suction pump out of an old blood transfusion tin, fitted with a wooden piston lined with leather. This worked admirably; it only wanted a willing worker to keep up the pumping. All traces of ammonia could be removed from the blood solution, if maintained at about 55°C. in about ten minutes.

The second difficulty was the most troublesome. For titration of ammonium salts in acid solution an indicator is required which has a colour change in the neighbourhood of pH 3 to 4. In the end I made some extracts

from a number of plants growing in the camp, and eventually found one, the leaves of which gave an alcoholic extract showing distinct possibilities. In acid solution the extract was red, in alkaline solution it turned green with a sharp colour change within two drops of N/30 calcium hydroxide. The question was at what pH did this colour change take place? It was lucky that among some notes I had with me was a table showing the relative proportions of acetic acid and sodium acetate required to make up a series of buffer solutions. Using acetic acid from the rice fermentation process and neutralising with sodium carbonate, a solution of sodium acetate was prepared. Combining this in the required proportions with acetic acid a series of buffers from pH 3 to pH 6 was prepared. By the use of these it was determined that the indicator concerned was red at pH 3, practically colourless at pH 4 and green at pH 5. This was a lucky find; it solved the biggest difficulty. A botanist subsequently identified the plant as *Ocimum gratissimum*, which is a source of thymol. The colour changes of this indicator, however, were not those of pure thymol.

The frothing of the blood solution under aeration, threatened for a short time to ruin all chances of making the method work. The usual anti-froth used is caprylic alcohol; none was available. After trying various substitutes it was discovered that a few drops of coconut oil was a perfect anti-froth.

Turmeric Paper

Turmeric was found growing in the camp, and from an alcoholic extract of this, strips of turmeric paper were prepared, which served as very useful visual controls (tell-tales) in the process of aeration. One strip placed in the glass tubing between the reaction tube and the absorption tube turned brown as soon as the ammonia commenced to pass over; when the flow of ammonia ceased the strip slowly changed back to its original colour, and thus served as an indication of the end point. A second strip placed after the absorption tube served as a check against any loss of ammonia.

It was found necessary, when using the aerating pump, to insert a large vessel in the system to act as a reservoir and buffer, otherwise the action of the pump caused too violent surges of air in the reaction tube. With this slight modification the lay-out of the apparatus followed the well-known normal lines.

Numerous blanks, checks, and replicates were run through in the apparatus before it was considered satisfactory. Having regard to all factors it was deemed advisable to carry out urea determinations on larger samples of blood than are usually taken: 5 mils were used for the estimations; this quantity gave a titration figure of about 1.5 mils N/30 calcium hydroxide. Since the tubing from which the burette was made showed a fall of liquid of about 3 inches per mil there was no difficulty in measuring accurately to 0.05 mil.

The details of the final method adopted were as follows: take 5 mils of whole blood or plasma, dilute it with 5 mils of distilled water, add crushed soya bean; allow to stand in a water bath at 55°C. for 20 minutes. Remove the tube, add a few drops of coconut oil and 2 to 3 gm. of slaked lime, cork quickly, and replace in aerating apparatus. Start aerating—it will be noticed that the first turmeric paper rapidly changes to brown—continue aeration until the turmeric paper regains its original colour (about 15-20 minutes). Remove standard acid absorption tube, which originally contained 5 mils N/10 acid diluted to about 40 mils. Back titrate against N/30 calcium hydroxide, using indicator mentioned.

Replicated estimations by this method gave results for blood urea agreeing to within one mgm. nitrogen per 100 mils blood. Urine urea determinations were carried out in a similar manner using a smaller quantity of urine.

Before concluding this account of the work carried out at the camp, I should like to record an episode which illustrates a rather remarkable feature of prisoner-of-war life. Shortly before leaving the camp I was engaged in trying to devise means of carrying out a Kahn test. For this purpose I was looking round for some possible source of cholesterol, and decided that I might obtain some from gallstones. I approached a sergeant who had recently been operated on for this complaint and had had over seventy stones removed. On asking him if he would let me have some of the stones for chemical purposes I met with the somewhat unexpected answer: "Sorry, sir, I've flogged them all."

It is a pleasure to record my sincere thanks to Lieut. Col. Coates, Australian Army Medical Corps, who was Allied Commandant of this camp, for his great encouragement to me in carrying out this work; and also to Major A. T. H. Marsden, R.A.M.C., Colonial Medical Service, and Captain J. Marcovitch, R.A.M.C., for their very helpful suggestions and criticism. Any observations or comments on the medical aspect of this work should rightly come from these officers. I have to thank them for an interesting insight into pathological work and for contriving to make the time spent on this work an enjoyable period of prisoner-of-war existence.

POSITION OF TEA AND RUBBER INDUSTRIES IN THE NETHERLANDS INDIES*

Various and conflicting reports are seen from time to time regarding the condition of tea and rubber plantations in the Netherlands Indies. In this connexion the following extracts from an article appearing in *Capital* will be of interest to our readers. The writer claims to have endeavoured to form an impression of the present and future economic prospects of the Netherlands Indies after having completed a three-weeks' tour of the country.

The total area under tea cultivation at the time of the Japanese occupation in Java, amounted to 260,802 acres. Reports are available over an area of some 171,580 acres prepared by the administration of the various gardens; it would appear that by the middle of 1945 an area of 134,120 acres was still under cultivation. Regarding the balance no reports are available. As from 1943 a large quantity of tea bushes were either uprooted or cut off at the roots. The land obtained in this fashion was frequently used for foodgrains and pulses; in some gardens pyrethrum was planted. With a few exceptions, where gardens remained under proper supervision, bushes have in most cases been allowed to grow wild, as a result of which (depending on soil and elevation) heights of 5 to 7 metres can be anticipated. It is certain that in view of the lack of regular pruning and of general neglect, a great deal of time and work will be necessary before these bushes can be considered productive. In those regions where entire gardens have been destroyed, it will be impossible to sow tea without revitalising the soil which has been exposed to floods and rains. This again will be a lengthy process.

The producing of tea was severely licensed and limited. In the year 1943 it did not exceed 4.3 million kgs., and 3.4 millions kgs. in 1944 consisting of about one-third native-grown tea. In comparison, the production figures for 1940 and 1941 were 62 million kgs. and 67 million kgs. respectively. This production was limited by international accord. Of the 220 tea factories operative in Java in 1941, about 50 remained operative, though the amount of leaf handled was small. The majority of the remaining factories were pulled down and partially dismantled, but it would appear that some 20 were converted by the Japanese for war production. On the East Coast of Sumatra, of the 1941 acreage of 53,050 about 33 per cent. has been uprooted or cut down. As in Java, a number of factories were converted for war production. There is very little news of the remaining tea gardens in Sumatra, though it is known that of Moera Laboch's 4,000 acres, about 22 per cent. was destroyed. It is, however, interesting to note that the tea produced in Sumatra in 1944 is assessed at 6 million kgs., which is in excess of Java, whereas the normal produce of Sumatra was about one-third that of Java. The potential standard production of Sumatra in 1941

* *The Planters Chronicle*, October 15, 1946.

was assessed at 6 million kgs. From the above it is obvious that the devastation wrought to the tea culture in Java and Sumatra, though hard to determine accurately, is of considerable proportions. On the other hand those concerned with the problem point out that the potential of these islands pre-war, exceeded considerably the amount produced, which was limited by international agreement. Assuming an over-all destruction of gardens and factories up to 33 per cent. the views expressed indicate that within a year or two of opening up of the interior of Java and Sumatra, production should approach the controlled production figures of 1941.

The total acreage under rubber taken over by the S.K.K.K. in 1942 was 610,002. Reports are available over some 95 per cent. of this acreage from which it appears that, at the middle of 1945, about 7 per cent. had been cleared for other purposes. Originally the Japanese cleared only the plantations which showed low returns and those which had been earmarked for clearing by the former owners. Later this policy was extended to other plantations in order to procure fuel for war industries. Apart from this in the more closely populated districts the population destroyed many trees for fuel. In the years 1942 and 1943 the plantations cleared by the Japanese were largely replanted with young trees of good quality. Later, however, this policy was discontinued, the land freed being used for growing food-grains and pulses. On some plantations, vegetables were grown among trees which must in time affect their yield. Up till 1944 quite a number of European managers remained at work, but these were replaced at the end of the year by Japanese and Indonesians. It must be borne in mind that the neglect of mature plantations, and the growing of extraneous plants amongst the trees, are of little consequence to their ultimate yielding capacity, though this is of course different in the case of younger trees. It is, therefore, safe to say that the majority of existing plantations are in reasonably good condition and could become fully productive in a relatively short time. During the War the centre of production was concentrated in West Java. In 1943 and in 1944 the production was 25,423 tons and 24,330 tons respectively, which represents about one-fifth of the potential production for the whole of Java according to 1941 figures. In some cases factories were dismantled, but this was not done as extensively as in the case of tea factories; several factories were converted to produce crepe soles, for which there was a great demand from the army.

On the East Coast of Sumatra, the acreage under rubber in 1942 was 638,152; it appears to have suffered more largely than Java, and it is estimated that about 14 per cent. of the plantations have been lost there. The rubber production in Sumatra for 1944 is estimated at only 13,500 tons (including 3,500 tons of latex rubber).

The concensus of opinion is that as soon as the plantations have become accessible, a volume of production equal to 50 per cent. of the pre-war production can be achieved within one year, and that full production can be reached at the second closing year of resumed work.

Notes and Comments.

GOVERNMENT GUARANTEED PRICES FOR PADI.

In order to encourage growers to sell to Government the greatest possible quantity of padi from the current season's harvest, the Government purchase price was increased with effect from 1st January, 1947, from $10 to $20 per picul of padi delivered at the mill. The price for padi purchased in the field was increased from $9.20 to $19.20 per picul. These new prices are guaranteed as the minima which will be paid during 1947.

Government has also increased the bonus paid to Government buyers of padi from $1 to $2 for every 10 piculs of padi brought in by them to the mill.

CESSATION OF TEA CONTROL.

The second International Tea Agreement, which restricted tea planting and regulated exports of tea, terminated in 1943 as far as Malaya was concerned. Accordingly, to remove the restrictions on the planting of tea in the Malayan Union, the Tea Control (Repeal) Ordinance, 1946, came into force on 10th December, 1946, and repeals all former legislation restricting the planting of tea in the Union.

LOWER PERAK AGRICULTURAL SHOW.

The Lower Perak Agricultural Show, held at the Government Rice Mill in Teluk Anson on Saturday and Sunday, December 7th and 8th, was opened by His Highness the Sultan of Perak in the presence of the Acting Governor-General and Lady Gent, the Resident Commissioner of Perak and H.H. the Raja Muda of Perak. More than 25,000 persons visited the Show. There was a large number of exhibits and most classes were represented, the fruit section being exceptionally large. Prizes were in general monetary, but the Malayan Agri-Horticultural Association had generously presented cloth and certificates for special exhibits. The Acting Governor-General gave a prize for the Teluk Anson Garden Competition which was won by Mr. Ramalingam of the Town Board. Twenty-one Government Departments or Institutes, including the Sakai Home in Tapah and War Crimes were represented. Entertainments included a kronchong, sepak raga and volley ball competitions, a cinema show, a ronggeng, a Chinese concert and the Sri Arjuna Revue. The bands of the Seaforth Highlanders and the Police played during the Show and the Anti-Tank Battery of the Royal Indian Artillery provided a guard of honour.

VERNACULAR JOURNALS OF THE DEPARTMENT OF AGRICULTURE.

Simultaneously with the re-appearance of the *Malayan Agricultural Journal*, publication of the three vernacular journals of the Department of Agriculture is recommencing in January, 1947, though printing difficulties may delay the actual date of publication. The journals are *Warta Perusaha'an Tanah*, *Ma Loy Chow Nung Nyip Tsung Poh* and the *Tamil Agricultural Journal*, and copies are supplied free of charge to genuine agriculturists and persons interested in agriculture in the Malayan Union. Applications should be addressed to the Department of Agriculture, Kuala Lumpur.

BROADCASTS TO VERNACULAR SCHOOLS.

A series of four broadcast talks to children in the vernacular schools on matters relating to school gardening has been prepared by Mr. J. R. P. Soper, State Agricultural Officer, Selangor. The talks are to be given during the school hour on Sundays at the end of January and early February. They will also appear in the vernacular journals of the Department of Agriculture and as a leaflet in English.

They were written more with the object of stimulating an interest in natural phenomena than of giving details of gardening practice. An imaginative approach more likely to appeal to the developing 11 year old mind was adopted in an attempt to counteract some of the ill effects produced by the cold matter-of-fact presentation which is more usually followed.

Departmental.

FROM THE DISTRICTS.

Compiled by the Agricultural Economist from Monthly Reports of Agricultural Officers.

December, 1946.

The Weather.

In most parts of the Peninsula heavy rains fell during the month. Dry weather was experienced in parts of Perak, and in Pahang the rainfall was substantially below the average. In Malacca also the rainfall was light, increasing only at the end of the month. Flooding was reported in many parts of the country and serious floods occurred in the main coastal padi area of Selangor.

Crop Reports.

Foodcrops and Vegetables.—In Kelantan considerable quantities of what are known as monsoon root crops, i.e., tapioca, sweet potato, yams, colocasia and groundnuts, were harvested and marketed during December.

Vegetable production increased in Penang with the cessation of the heavy rains. Planting of foodcrops is being carried out on the padi field bunds and nearly 10 piculs of maize seed were distributed free to padi planters in one district for this purpose.

In north Perak Chinese squatters showed sustained interest in the planting of tapioca, sweet potato and colocasia. Exports from Perak during December were (in piculs): vegetables 10,492, tapioca flour 12,252, fruits 5,982, miscellaneous foodstuffs 2,655.

In Selangor large areas of sweet potatoes were harvested during the month and the price to growers fell to $4 per picul. One estate is converting the tapioca crop to flour by having dried chips milled which it proposes selling to Government at the fixed price of $20 per picul.

In Malacca with the advent of the padi harvest, less interest was evinced in foodcrop cultivation, except amongst professional gardeners. There was a marked increase in the production of beans and peas by Chinese market gardeners, but a decline in leaf vegetables followed the very wet weather in November. Off-season cultivation of padi fields was extended by a further 21 acres during the month. A much larger area would be cultivated in this way were it not for the high rental demanded by the Malays from whom the Chinese gardeners lease their holdings. The completion of the main padi harvest should see a substantial increase in the acreage under off-season cultivation. So slight is the demand for tapioca that the crop is being offered at 50 cents per picul in Jasin *ex* plantation. An interesting departure from normal practice is the opening up of a small vegetable garden by a number of Malay women in one district.

In Johore North the area under foodcrops is steadily decreasing as little replanting is being carried out to replace the harvested areas. With a drop in the price of uncontrolled rice, there is little or no demand for tapioca and sweet potato, and the latter is being used as a pig food. In Johore Central, on the other hand, there was a slight increase in the acreage under foodcrops. In Johore South also a satisfactory area was planted with vegetables and foodcrops.

Wet Padi.—In Kedah harvesting has already commenced of the early planted wet padi. Local padi planters were satisfied with the latest price guaranteed by Government and many who neglected to plant padi are now sorry that they did not do so. Arrangements are being made by local planters to work uncultivated land in the coming season which will increase the cultivated area substantially. In some districts excessive water has impeded harvesting.

The more or less continuous recent wet weather has improved the appearance of the crop in Kelantan. Some areas were flooded during the month, but the plants were sufficiently well-grown to escape serious damage. The harvest of the early wet padi is now nearly complete, and planters who have average yields of 100 to 200 gantangs per acre express themselves as satisfied with the result.

Transplanting of late planted wet padi has now been completed in Trengganu and prospects are generally good. Flooding has caused losses of early planted wet padi. Normally the crop is harvested before there is any serious flooding, but as this type of padi has to be planted on the lowest land, which is certain to be flooded sometime during the year, the risk is always present. In one district about 80 per cent. of the earlier planted crop has now been harvested with yields generally better than last season. In Kuala Trengganu District, flooding has been extensive and in some mukims it is thought that half the crop has been lost over an area of 2,000 acres.

In Province Wellesley North, harvesting of areas of short term padi varieties has commenced, but the yield is estimated at not more than 250 gantangs per acre. These short term varieties were grown in the hope of obtaining a high price early in the harvesting season, but the price of $20 per picul offered by Government together with the comparatively light yield obtained has made this experiment considerably less profitable than growing the usual 6-months padi. Planting has been completed in nearly all the other parts of the Settlement. For the late areas it is fortunate that the wet weather continued to the end of the month, and crop prospects are much more promising than might usually be expected from so late a season. The import of bat guano from Kedah was completed in the early part of the month and altogether a total of 774 tons have been imported for the plough land of Province Wellesley North and Central. The total imports by the Department are estimated to have served 9,000 acres of padi land in these districts.

In parts of Perak the padi is now between the tillering and flowering stages, but in some localities planting of wet padi is still proceeding. The uneven planting is due to the early dry condition followed in some parts by flooding. Planting in the late areas of the Sungei Manik Irrigation Scheme was completed during the month and draining of the earliest planted areas commenced in the first half of the month.

In Selangor, planting is in full swing at Panchang Bedena in the main coastal area, about 50 per cent. having been completed. Serious flooding occurred in the coastal area during the month but the damage was not so severe as at first feared. A total of 650 acres is being resown with short term seed obtained from Sabak Bernam. All available seedlings from unused nurseries were being collected and distributed to fill as much of the damaged plots as possible. The seedlings were used where resowing was inadvisable owing to the difficulties of subsequent water control. Harvesting has commenced in other parts of the State and in some areas is almost complete. The sowing of a second crop in one district was completed by the middle of the month.

It is estimated that about 30 per cent. of the crop in the Lipis District of Pahang has been harvested. The crop in this District will be very much better than the previous season. In Pahang South also harvesting has commenced and 80 per cent. of the crop in the Temerloh District was harvested by the end of December. The crop is a good one in the majority of the areas. Harvesting commenced in the Bentong District about the middle of the month. The Chinese in this Circle are harvesting excellent crops.

With the increase in the Government price for padi from $10 to $20 per picul at the mill and from $9.20 to $19.20 in the field with effect from 1st January, 1947, the sale to Government becomes a practical possibility and arrangements were being made to organize the buying side of the Government Rice Mill, Temerloh, to cope with the new conditions.

Harvesting was in progress in all the three Districts of Malacca. Only mediocre crops are expected from the Central East areas where the majority of the padi suffered from lack of water at planting.

Rubber.—The heavy rains of December restricted tapping considerably, but the number of holdings in tapping remained high. The wet weather increased the incidence of Mouldy Rot, but control measures were adopted satisfactorily in most parts of the country. Pink disease was reported in Kedah and advice on control measures was given.

In Kelantan a number of smokehouses are being built by co-operative effort, and a plan for a standardized type is being prepared by the Asiatic Rubber Instructor. Coagulants are still very short in some parts of Trengganu.

Supplies of disinfectant for the treatment of Mouldy Rot were distributed in Perak. Many holdings suffer from neglect during the occupation

period and no attempt has been made by some owners to slash the undergrowth and generally improve the sanitary condition of their holdings.

Yields of rubber in Selangor are dropping after the first flush of resting.

West Pahang is still short of coagulants and black market prices are being paid for inferior substitutes. Four smokehouses were erected. Numerous enquiries were received in Malacca regarding replanting.

Fruit.—Good crops of the principal fruits, durian, rambutan and mangosteen were reported from all parts of the country. In Trengganu the fruit season was considered the best for some years.

Coconuts.

Two Penang mills ceased to operate at the end of the month and the price of copra cake jumped to $20 per picul. Copra production in one district of Selangor was impeded by the wet weather and flooded kilns. The price of copra varied from $11 to $14.50 per picul at the coastal oil mills. Copra cake was sold at $16 per picul.

In Malacca wide fluctuations were recorded in fresh nut prices, varying from 8 to 10 cents in town to 1½ to 2 cents in producer districts. High transport and labour charges account for this difference. It is reported that in one district prices were considered so unremunerative that it was not worth while harvesting the nuts. Fifteen small copra mills were reported to be in operation in Malacca Settlement, with a total monthly production of 270 piculs.

In the Muar District of Johore North, fairly large quantities of copra are being produced. The quality of this copra is not high, and the owners are not inclined to try to improve it either by building better kilns or by grading. The manufacture of coconut sugar continues although in some localities the price has fallen to 20 cents a kati. In Johore Central the demand for coconut shells for latex cups continues, the price being $17 per thousand. In Johore South, owing to competition from imported edible oils, the price of coconut oil dropped from $8.40 to $5.50 per 4-gallon tin. The local oil mill has closed down owing to this drop in price and the high costs of production.

Poultry.

Local hatcheries in Malacca reported an output of 26,400 chicks and ducklings during the month.

In Johore further importations of Australian chicks have ceased until the end of the wet season. The hatchery in the Kota Tinggi District produced approximately 130,000 chicks and ducklings during the month. Considerable quantities of fowl and duck eggs were exported from this locality to Singapore.

Fish.

The stocking of fish ponds in the Raub District, Pahang, continues and a further 2,000 fry were imported during the month. A number of fish ponds have been made in Perak by Chinese interested in the rearing of carp.

Miscellaneous.

School and Home Gardens.—The visiting of school gardens by members of the Field Staff of the Department was continued during the month. These visits are bearing fruit, and work in the gardens generally shows a considerable improvement. Compost making is now carried out regularly by most schools with beneficial results. In some States fruit areas neglected during the war are being rehabilitated.

In districts of Pahang where padi harvesting is in progress, teachers and scholars have been urged to collect padi straw for composting or for mulching permanent crops.

The State Agricultural Officer, Selangor, assisted in the final judging of the Home Garden Competition held in the Ulu Langat District. There were some very creditable entries in the Malay Section.

Home Garden and Livestock competitions were held in Penang and Province Wellesley and aroused considerable interest in the kampongs. District Officers assisted in judging the Home Gardens, and Veterinary Inspectors in judging the livestock.

Agricultural Competitions.—Two highly successful and well-attended Agricultural Competitions were held in North Perak, one at Bagan Serai and the other at Taiping. The competitions aroused considerable interest and the standard of the exhibits was commendably high.

DEPARTMENTAL NOTES

Obituary.

It is with the greatest regret that we record the severe loss suffered by the Department of Agriculture by the death of the undermentioned officers on active service during the recent war:

J. A. Baker, Agricultural Officer, a private in the Kedah Volunteer Force, killed in action in Perak in December 1941.

C. H. Burgess, Agricultural Officer, Lieutenant, 4th Battalion, F.M.S.V.F., attached to 11th (Indian) Division as Liaison Officer, died in December 1942 of diptheria at Chungkai Camp, Thailand.

N. H. Sands, Agricultural Officer, Lieutenant, S.S.V.F., attached to 18th (British) Division as Liaison Officer with 85 Anti-Tank Regiment, R.A., died in December 1942 of diphtheria at Chungkai Camp, Thailand.

T. W. Brown, Botanist, Sergeant, Signal Coy., S.S.V.F., died in January 1944 of bacillary dysentery at Nong Pladuk No. 2 Camp, Thailand.

C. L. Newman, seconded to Sarawak as Director of Agriculture, Sarawak, and subsequently released for service as a 2nd Lieutenant in the Indian Army. He is presumed to have died or been killed in Borneo on or after the 24th March, 1942.

Yong Yoon Choi, Agricultural Assistant Grade II, Lieutenant, Malacca Volunteer Corps. Lieut. Yong Yoon Choi was mobilized in December, 1941, and served throughout the campaign. He was one of a party of 26 Volunteers who were slaughtered by the Japanese after the fall of Singapore.

We regret also to record the death of Mr. G. D. P. Olds, Agricultural Officer, during the period of the war. Mr. Olds, who was a Pilot Officer in the Malayan Volunteer Air Force, was on active service flying in Malaya after the outbreak of war. He was later ordered to Pekan Baroe in Sumatra, from where he went to Java and thence to Australia. Mr. Olds was subsequently posted to British Honduras as an Agricultural Officer, where he died in 1942 from peritonitis following an operation for appendicitis.

We extend to the relatives of our late friends and colleagues our very real sympathy in their bereavement.

Appointment.

Mr. R. J. A. W. Lever, Entomologist, has been transferred to the Malayan Agricultural Service from Fiji. Mr. Lever arrived in Malaya on 14th December, 1946.

Leave:

Mr. R. B. Jagoe, Botanist, returned from leave on 11th December, 1946.

Mr. B. A. Lowe, Agricultural Officer, Cameron Highlands, has been granted 86 days' leave, exclusive of voyages, from 31st December, 1946.

RETIREMENT OF MR. W. N. C. BELGRAVE, B.A., Dip. Agr. Sci. (Camb.).

Mr. W. N. C. Belgrave, former Director of Agriculture, Straits Settlements, and Adviser on Agriculture, Malay States, retires on 29th January, 1947, after leave prior to retirement. Mr. Belgrave first came to the Department in November 1914, and has thus served Malaya for over 32 years. Mr. Belgrave's first appointment was as Assistant Mycologist; he later became Plant Physiologist, and was placed in charge of the Division of Soils and Plant Physiology in 1927. In 1929 he attended the Fourth Commission of the International Society of Soil Science at Konigsberg, and the same year was a Delegate to the Second Imperial Mycological Conference at London. In 1931, Mr. Belgrave became Chief Research Officer, which post he filled with conspicuous success until his appointment in January, 1939, as Head of the Department of Agriculture.

Mr. Belgrave will long be remembered for his work on Malayan soils and manurial problems, particularly in connexion with oil palms and coconuts, and the publications of the Department bear witness to his considerable contribution to agricultural literature.

Mr. Belgrave's intimate knowledge of Malayan agriculture, coupled with an ability for critical analysis of all problems, based on his extensive scientific background, enabled him to be a source of help and encouragement to all officers working under him.

Mr. Belgrave fortunately survived the rigours of internment with moderately good health, though he suffered severely from the serious eye trouble that was prevalent in Changi Gaol. He rendered the Camp valuable service in an advisory capacity in connexion with the development of vegetable gardens, and later at the Sime Road Camp assumed the onerous duties of Commandant of North Area.

His many friends in the Department learned with considerable pleasure of his marriage in 1946, and wish him many happy years of retirement.

RETIREMENT OF DEPARTMENTAL OFFICERS.

In addition to Mr. Belgrave the following senior officers of the Department of Agriculture who were interned in Singapore during the war have retired and are not returning to Malaya.

Mr. F. Birkinshaw, Chief Field Officer, retired on 26th September, 1946, after 34 years service, of which the last 26 years were spent in Malaya.

Major C. D. V. Georgi, O.B.E., Chief Research Officer, retired on 21st November, 1946, after 26 years service.

Mr. D. H. Grist, Agricultural Economist and editor of the *Malayan Agricultural Journal*, retired on 17th September, 1946, after 32 years service.

Mr. G. E. Mann, Principal, School of Agriculture, Malaya, retired on 24th July, 1946, after 25 years service.

Mr. G. H. Corbett, Senior Entomologist, retired on 3rd July, 1946, after 26 years service.

Mr. A. E. Coleman-Doscas, State Agricultural Officer, Johore, retired on 26th July, 1946, after 26 years service.

Mr. N. C. E. Miller, Entomologist, retired on 24th August, 1946, after 18 years service in Malaya.

Mr. R. A. Altson, Plant Pathologist, retired on 16th September, 1946, after 23 years service, of which the last 18 years were spent in Malaya. Mr. Alston has recently returned to Malaya to take up an appointment with the Rubber Research Institute of Malaya, and we wish him every success in his new work.

We extend to all our former friends and colleagues our very sincere wishes for many happy years of retirement.

H. L. B.

Statistical.

MARKET PRICES.

December 1946.

Rubber.—There was a slight advance in the Singapore price of rubber during the month. No. 1 Ribbed Smoked Sheet opened at 41¾ cents per lb. and advanced to 42⅞ cents per lb. in the early part of the month, easing to close at 42 cents per lb.

The average of daily quotations for the month was 41⅝ cents per lb. Average prices for London and New York are not available.

Prices paid for small-holders' rubber at three centres during the month are given in Table I.

Table I.

Weekly Prices Paid by Local Dealers for Small-Holders' Rubber, December, 1946.

(Dollars per picul of 133⅓ lbs.)

Grades	Ipoh, Perak.				Kuala Pilah, Negri Sembilan		Batu Pahat, Johore.			
	4	11	18	25	16	23	7	14	21	28
Smoked Sheet ..	50.00	49.50	50.50	50.50	49.00	49.50	50.91	51.41	51.41	51.41
Unsmoked Sheet ..	43.00	42.50	43.00	43.00	43.00	43.00	45.30	45.30	45.00	45.00
Scrap ..	18.00	17.50	20.00	20.00	16.50	16.50	23.15	23.00	21.75	21.75

Transport from Batu Pahat to Singapore by lorry, excluding duty, $1.00 per picul.

Table II.

Singapore Prices of Various Agricultural Products.

Product	December, 1946			November, 1946	Average Price Jan.-Oct. 1941
	Highest	Lowest	Average	Average	
	per picul $	per picul $	per picul $	per picul $	per picul $
Copra:					
Sundried No. 1 ..	14.00	12.00	13.31	14.00	2.58
No. 2 ..	13.00	12 50	12.70	13.50	2.33
No. 3 ..	12.00	12.00	12.00	*	
Coconut Oil ..	26.00	24.00	24.86	25.90	8.64
Coffee:					
Padang Bali No. 1 ..	100.00	82.00	82.50	71.25	*
No. 2 ..	90.00	31.00	56.67	63.75	*
Palembang No. 1 ..	37.00	30.00	34.32	32.75	18.07-19-91
Sourabaya New No. 1	68.00	60.00	65.00	60 00	19.13-21.02
Bali Old ..	110.00	92.00	97.50	87.50	*
Pepper:					
Muntok White ..	112.00	98.00	100.75	109.00	15.33
Lombong White ..	96.00	82.00	89.00	94.00	*
Sibu White ..	106.00	90.00	97.50	104.00	*
New Black ..	110.00	90.00	101.75	110.00	*
Old ..	108.00	92.00	99.75	108.00	*
Sarawak ..	104.00	104.00	104.00	104.00	*
Siam Black ..	94.00	85.00	92.25	*	*
Nutmeg:					
No. 1 ..	115.00	90.00	100.50	*	25.19
No. 2 ..	92.00	70.00	83.33	*	23.66
Cloves:					
Indian ..	41.00	38.00	39.50	40 00	*
Sumatra ..	65.00	40.00	55.25	62.50	*
Gambier: ..					
Cube No. 1 ..	110.00	90.00	97.50	119.80	13.65
No. 2 ..	100.00	75.00	83.30	98.00	*
Cake ..	110.00	110.00	110.00	*	*
Sago Flour:					
Lingga ..	22.50	20.50	21.25	*	*
Local No. 1 ..	20.50	15.50	18.00	14.38	*
No. 2 ..	17.00	13.50	15.50	11.90	*
Tapioca Flour:					
Malayan No. 1 ..	30.00	21.00	24.00	26.87	*
No. 2 ..	21.00	20 00	20.50	22.25	*
Java ..	33.00	28.00	31.50	32.00	*

* Not quoted.

MALAYAN UNION PRODUCTION OF PALM OIL AND KERNELS.

(In long tons as declared by Estates)

Month 1946	Palm Oil	Palm Kernels
May	319.8	—
June	355.9	—
July	502.2	—
August	1,660.0	37.9
September	1,758.7	54.4
October	2,284.7	158.6
November	2,324.8	298.4
December	2,550.3	382.3
Total ..	11,756.4	931.6
Total for the year 1940	57,972.1	9,611.2

Stocks on estates as at 31st December, 1946, were: palm oil 1,656 tons, palm kernels 310 tons.

MALAYAN AGRICULTURAL EXPORTS, SEPTEMBER, 1946.

Product	Net Exports in Tons.		
	Year 1940	September 1941	September 1946
Arecanuts	43,915	119	1,281*
Coconuts fresh†‡ ..	131,469†	10,372†	260*†
Coconut oil‡	69,446	6,245	725
Copra‡	9,004*	3,291*	4,072*
Copra cake	1,215*	119	113*
Gambier, all kinds ..	821	75	130*
Palm kernels	9,219	250	—
Palm Oil	55,990	4,407	889
Pineapples, canned ..	40,243	1,044	22
Rubber¶	547,202¶§	55,402¶§	43,270¶§
Sago,—flour	2,525	1,791	648*
„ —pearl	4,848	547	1
„ —raw	4,816*	409*	133*
Tapioca,—flake ..	762	55	8*
„ —flour ..	2,649*	458*	13
„ —pearl ..	17,004	851	115
Derris	1,254	3,883	46
‡Copra equivalent ..	108,468	7,046	5,245*

† hundreds in number. * net imports. ¶ production.

§ Malayan Union and Singapore.

MALAYAN UNION RUBBER STATISTICS.

Estates of 100 Acres and over. Production and Stocks December, 1946.

In Dry Tons.

STATES (1)	PRODUCTION						STOCKS	
	European (2)	Chinese (3)	Indian (4)	Others (5)	Total December (6)	Total* May to December (7)	Beginning of Month* (8)	End of Month (9)
Perak ..	4,031	374	221	22	4,648	29,319	3,194	3,521
Selangor ..	4,108	416	109	4	4,637	29,388	4,071	3,923
N. Sembilan ..	2,967	256	96	104	3,423	21,378	2,870	2,468
Pahang ..	782	499	88	—	1,369	10,814	1,204	954
Malacca ..	1,108	414	84	—	1,606	10,213	1,267	1,133
P. Wellesley and Penang	309	79	3	—	391	2,731	333	336
Johore ..	3,193	794	172	415	4,574	29,476	3,502	2,972
Kedah ..	3,127	481	137	34	3,779	22,868	2,368	2,615
Perlis ..	—	3	23	—	26	162	31	31
Kelantan ..	194	22	—	11	227	2,182	269	235
Trengganu ..	31	16	—	—	47	545	90	87
Total ..	19,850	3,354	933	590	24,727	159,076	19,199	18,275

Notes:—1. *Columns 7 and 8 are amended to take into account late returns, and the latest table is, therefore, the most reliable.

2. Production by estates of less than 100 acres for December, 1946 was estimated to be 29,448 tons. Total estimated small-holding production May to December, 1946, 179,708. tons.

3. Stocks on estates of less than 100 acres are not ascertained.

4. The above forms part of the December rubber statistics published by the Registrar of Statistics, Malayan Union, at Kuala Lumpur on 21st January, 1947.

MALAYAN UNION RUBBER STATISTICS.

Summary of Stocks, Production, Imports and Exports of Rubber, December, 1946.

In Long Tons, Dry Weight.

		Tons	Tons
STOCKS (30th November)			
Estates (amended)	..	19,199	
Dealers	..	50,357	
Ports, awaiting shipment	..	17,115	86,671
IMPORTS	..		4,629
PRODUCTION			
Estates	..	24,727	
Small-holdings (estimated)	..	29,448	54,175
			145,475

		Tons	Tons
EXPORTS			
Foreign	..	36,869	
Local (to Singapore)	..	16,856	53,725
LOCAL CONSUMPTION	..		1,323
STOCKS (31st December)			
Estates	..	18,275	
Dealers	..	62,958	
Ports, awaiting shipment	..	9,194	90,427
			145,475

Note:—The above forms part of the December rubber statistics published by the Registrar of Statistics, Malayan Union, at Kuala Lumpur, on 21st January, 1947.

MALAYAN UNION

PADI SEASON 1946—1947.

Acreages of Wet Padi Planted monthly during 1946 and Percentages of Total Planted Area.

STATE (1)	September (2)		October (3)		November (4)		December (5)		Total (6)		Total Area Planted and to be Planted (7)	Per cent (8)
	Planted Acres	Per cent of (7)	Planted Acres	Per cent of (7)	Planted Acres	Per cent of (7)	Planted Acres	Per cent of (7)	Planted Acres	Per cent of (7)		
Perlis ..	29,470	80.5	4,260	11.5	2,700	8.0	210	—	36,640	100.0	36,640	5.0
Kedah ..	116,660	49.0	64,960	27.0	47,110	20.0	8,090	3.0	236,820	100.0	236,820	32.0
Kelantan ..	30,675	23.5	4,838	3.5	49,048	37.0	9,928	7.0	132,814	98.0	135,014	18.0
Trengganu ..	—	—	14,346	40.0	12,722	37.0	7,703	22.0	34,771	100.0	34,794	5.0
Penang & P. Wellesley	4,406	12.0	18,570	51.0	12,366	34.0	1,252	3.0	36,594	100.0	36,594	5.0
Perak ..	41,942	40.0	18,812	18.0	24,372	23.0	19,992	19.0	105,118	98.0	106,964	14.0
Selangor ..	3,937	11.0	7,871	22.0	2,467	7.0	5,662	16.0	19,937	55.0	36,092	5.0
Pahang ..	2,566	6.0	1,087	2.5	1,065	2.5	542	1.0	39,639	97.0	40,827	6.0
N. Sembilan ..	2,420	8.0	474	1.5	87	—	49	—	29,612	96.0	30,987	4.0
Malacca ..	10,536	35.0	3,723	12.0	327	1.0	272	—	30,611	100.0	30,611	4.0
Johore ..	9,043	66.0	1,799	13.0	915	6.0	443	3.0	12,200	86.0	14,042	2.0
	251,655	34.0	140,740	19.0	153,179	21.0	54,053	7.0	714,756	97.0	739,385	100.0

Compiled by the Registrar of Statistics, Malayan Union, from returns received through the Field Branch of the Department of Agriculture.

	JULY. Acres	AUGUST. Acres
Kelantan ..	—	38,325
Pahang ..	23,429	11,040
N. Sembilan ..	23,356	3,226
Malacca ..	10,713	5,040
	57,498	57,631

MALAYAN UNION

PADI SEASON 1946—1947.

Total Acreages of Wet and Dry Padi Planted and to be Planted.

STATE	WET PADI		DRY PADI Total Planted and to be Planted	TOTAL Wet and Dry Padi Area Planted and to be Planted.
	Planted by 31st December, 1946 Acres	Total Planted and to be Planted Acres	Acres	Acres
Perlis ..	36,640	36,640	60	36,700
Kedah ..	236,820	236,820	4,390	241,210
Kelantan ..	132,814	135,014	29,893	164,907
Trengganu ..	34,771	34,794	18,182	52,976
Penang & P. Wellesley ..	36,594	36,594	840	37,434
Perak ..	105,118	106,964	13,371	120,335
Selangor ..	19,937	36,092	4,614	40,706
Pahang ..	39,639	40,827	2,334	43,161
Negri Sembilan ..	29,612	30,987	40	31,027
Malacca ..	30,611	30,611	130	30,741
Johore ..	12,200	14,042	4,456	18,498
Totals ..	714,756	739,365	78,310	817,695

Compiled by the Registrar of Statistics, Malayan Union, from returns received through the Field Branch of the Department of Agriculture.

Estimated Total Yield 1946—1947 = 275,000 tons of rice.

1940—1941 Wet Padi ..	742,600 acres.		1945—1946 Wet Padi ..	684,005 acres.	
Dry „ ..	77,880 „		Dry „ ..	105,635 „	
Total ..	820,480 „		Total ..	789,640 „	
Total Yield 324,211 tons of rice.			Total Yield 225,044 tons of rice.		

METEOROLOGICAL SUMMARY, MALAYA, NOVEMBER, 1946.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes,						Total.		Most in a day.	Number of days					Total	Daily Mean	Per cent.
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
Ipoh, Perak ...	91-3	72-5	81-9	95	71	85	75			10-12	257-0	1-58	22	18	2					
Port Swettenham, Selangor	88-9	72-8	80-9	93	71	84	74	84-7	85-0	9-43	239-5	1-42	18	18						
Sitiawan, Perak ...	87-6	73-3	80-5	90	72	83	75			12-03	305-6	1-66	23	22	5	3				
Kuala Lipis, Pahang ...	86-6	72-4	79-5	91	71	78	74	83-3		4-09	103-9	0-62	22	17	2	26				
Kuantan, Pahang ...	86-8	73-3	80-0	91	71	78	75			19-31	490-5	6-61	19	19		1				
Bayan Lepas, Penang ..	87-2	74-4	80-8	90	73	83	77			11-99	304-5	3-81	26	21	9					
Malacca ...	85-8	74-1	79-9	91	72	83	76			7-90	200-7	1-86	23	18	2					
Mersing, Johore ...	85-2	72-9	79-1	92	71	78	74			10-27	260-9	2-94	24	20						
Alor Star, Kedah ...	88-5	73-2	80-9	92	71	79	75			6-47	164-3	1-54	21	19	5	16				
Kuala Trengganu, Trengganu	84-8	73-0	78-9	89	72	75	75			27-69	703-3	3-68	27	27	2		3			
HILL STATIONS. Fraser's Hill, Pahang 4268 ft.	71-0	62-2	66-6	76	60	65	64	70-2		9-62	244-3	1-80	21	18	1	19	1			
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72-5	57-7	65-1	76	53	67	64	69-6		11-57	293-9	1-86	23	22	2	1	.			

Compiled from Returns supplied by the Meteorological Branch, Malaya.

THE
Malayan Agricultural Journal
APRIL, 1947

EDITORIAL.

The Kidney Worm of Pigs. Considerable work was carried out at the Central Experiment Station, Serdang, prior to the war in connexion with the infestation of pigs by the kidney worm (*Stephanurus dentatus*, Deising, 1839). Experiments were made to investigate the popularly held belief of Chinese pig-breeders that cooked banana stems help to control the pest, and fortunately the records of that investigation have survived the occupation and are published as an article in this issue.

The results of the experiment show that banana stems do not possess any special anthelmintic properties, but they appeared to have a healing effect on internal organs suffering from the earlier effects of the parasites, consequently resulting in a higher percentage of healthy livers and kidneys.

Possibly the most important discovery as a result of the experiment was that infestation by the kidney worm can apparently be eliminated by the careful daily sluicing of concrete-floored styes. The eggs of the parasite are voided in the urine, and, provided concrete-floored styes only are used and sluiced daily, the infestation comes to an end as the kidney worm appears to have a mature existence of only a few months.

Central Experiment Station, Serdang. The article in this number describing conditions on the Department's Central Experiment Station at Serdang during and after enemy occupation is of interest, showing as it does, how very rapidly in the tropics the results of years of careful research work can be lost or vitiated by a period of neglect. Fortunately the damage at Serdang was not beyond repair. During the past 18 months considerable and hard work has been put into the Station, and while the results of much experimental work are irretrievably lost, and a large number of crops have been lost, new experiments are being laid down, the oil palm and tea factories are once again in production, new stocks of planting materials are being raised, and the Station is rapidly recovering from the long period of neglect.

Emergency Food Production. Attention is drawn to the article appearing in this number which recounts the important developments which have now taken place in the direction and organization of emergency food production in the Malayan Union.

Until recently the Department of Agriculture had not been responsible for the development of emergency food production areas, with the exception of wet padi areas, since a separate organization had existed for that purpose under the direction of a Food Executive Committee.

By a directive of His Excellency the Governor this temporary organization has been absorbed into the Department of Agriculture with effect from 1st March, 1947, and the administration of all emergency food production is now the responsibility of the Director of Agriculture.

Prompt steps have been taken to survey all Government Farms which were in process of development, and a Technical Committee, consisting of senior officers of the Department, has already reported the result of their inspection of these farms.

One of the most important changes in policy concerns the use of mechanical equipment. Thorough investigations are being carried out into the possibilities of mechanized cultivation in Malaya before accepting mechanization as a means of large scale food production, and a whole hearted drive to produce padi, wet or dry, in preference to other cereals or root crops is in progress.

Local Tobacco.

Javanese small-holders in the Kuala Langat District of Selangor, produce a tobacco prepared for smoking in a wrapper of dried immature leaves of the nipah palm. The crop is cultivated on peat and average yields of prepared "tembakau rachit" of approximately 4 piculs per acre are obtained within three months of planting. In an article, included in this issue, Abdul Hamid bin Haji Hussein, Malay Agricultural Assistant, gives a full account of the methods of cultivation and of the simple manufacturing process adopted by the growers.

Original Articles.

KIDNEY WORM OF PIGS

Effects of Feeding Banana Stems to Infested Pigs

BY

T. D. MARSH,

Senior Agriculturist,

AND

N. KANAGARATNAM,

Stock Farm Assistant.

In a previous article (1) on this parasite of pigs of tropical and sub-tropical countries, it was recorded that "no anthelmintic is known that will eradicate the worms from the kidneys of infested pigs, but that Chinese pig keepers have a firm belief that cooked banana stems have a definite action in checking the ravages of the pest or ameliorating its effects on infested animals." It was further stated that experiments were being made to test this contention at the Central Experiment Station, Serdang.

The experiment mentioned above was commenced in May, 1940, and terminated on December 20th, 1940. It was designed to ascertain whether cooked banana stems in pig rations had any anthelmintic properties or had any ameliorating effects on the viscera, particularly the kidneys and livers, of infested pigs.

If banana stems possessed such properties it could be inferred that a ration containing this ingredient would provide greater live-weight increases when fed to infested pigs than would be obtained by feeding a similar ration but containing no anthelmintic. To test these points live-weight gains were recorded of all pigs under trial.

The State Veterinary Surgeon, Selangor, collaborated in the periodic examination of urine samples and made a report on the post-mortem examination of the carcases and internal organs.

Towards the end of April, 1940, urine samples were collected from twelve pigs in a Chinese piggery, nine of which were voiding eggs of the parasite in the urine. Eight pigs approaching slaughter weight which were positively proved to be infested with the kidney worm were selected and purchased as suitable subjects for the experiments.

Since the maturation period of the parasite within the host is approximately six months, animals under this age could not be voiding eggs of the parasite in the urine; in consequence it was necessary to conduct the experiment on animals approaching maturity.

The pigs on arrival at the Central Experiment Station, Serdang, were divided into two groups of four animals so that the total weights of the four

pigs in each group, A and B, were almost identical, as recorded below in Table I.

Table I.

Weights of Pigs at Commencement of the Experiment.

Group A.

No.	Breed	Sex.	Weight lbs.
281	Large Black ..	Gilt	124
282	Large Black ..	Gilt	152
283	Large Black ..	Gilt	132
288	Middle White X Chinese	Gilt	167
		Total	575

Group B.

284	Large Black ..	Gilt	153
285	Large Black ..	Castrated male (barrow)	149
286	Large Black ..	Castrated male (barrow)	113
287	Large Black X Middle White X Chinese ..	Castrated male (barrow)	159
		Total	574

The grouping, in order to provide equal weights in each lot, separated most of the males from the females.

The two groups of pigs were provided with similar housing accommodation about half a mile from the pig farm. The floors of the pens and the surrounding drains were constructed of concrete.

Precautions were taken to prevent the dissemination of the eggs and larvae of the parasite by directing all drainage from the styes to a concrete sump. The contents of the sump were treated with a 5 per cent. solution of copper sulphate to destroy the parasites therein; after being mixed with lime, all dung and drainings were buried in trenches in an area of land not used for growing pig food. The labourer who attended the animals was provided with a tub of disinfectant to wash his feet following each visit to the pens.

Table II shows the rations fed throughout the period of the experiment.

Table II.

Rations fed during the Experiment.

Group A.		*Group B.*	
	lbs.		lbs.
Banana stems cooked ..	30	Banana stems ..	nil
Tapioca roots ..	40	Tapioca roots ..	40
Guinea grass ..	5	Guinea grass ..	10
Broken rice ..	2	Broken rice ..	2
Rice polishings ..	7	Rice polishings ..	7
Coconut cake ..	3	Coconut cake ..	3
Groundnut cake ..	2	Groundnut cake ..	4
Fish refuse ..	2	Fish refuse ..	2
Minerals ..	1	Minerals ..	1

The constituents of the rations were calculated to conform closely to standards for animals of the weights recorded at the commencement of the experiment; the albuminoid ratio became a little narrow for the optimum live-weight increases as the animals became heavier. It was considered inadvisable to change the ration for the sake of live-weight gains. Slight variations in some of the ingredients of the rations were necessary to provide, as near as possible, the supply of an equal amount of dry matter, digestible crude protein, fat and nitrogen free extract (carbohydrates). There was a marked difference in live-weight gains in pigs of the two groups which is discussed later.

The reports by the Veterinary Surgeon, Selangor, on the urine tests are given in Table III.

The examination of the urine of the individual pigs before purchase was recorded with only a rough indication of the number of eggs present; actual counts from a specific quantity of urine were not made until the fourth series of samples were examined.

These tables of counts show that there was during the experiment a general diminution in the number of eggs voided in the urine in seven out of eight of the pigs under test, the last record of pig No. 288 in the banana stem group being the exception. This gradual fall in egg numbers occurs in both groups and it would appear, therefore, that the animals received an early infestation, probably when they were allowed to roam about the kampong as suckling or weaner pigs. The daily sluicing of the floors of the styes prevented any further infestation.

The trial was terminated owing to the pigs becoming over weight for sale as porkers.

The four animals in each group were delivered to the abbatoirs on succeeding days to eliminate any possibility of mixing the carcases.

The report of the State Veterinary Officer, Selangor, on the condition of the carcases, the liver and kidneys, of each pig under trial, is given verbatim hereunder.

Table III.

Summary of Reports on Urine Tests by the Veterinary Surgeon, Selangor.

Group A. Banana stems fed in ration.

	No. of eggs in microscopic field.			No. of eggs per 100 ml. of urine.		
Date of test	30.5.40	11.6.40	25.6.40	21.8.40	19.10.40	29.11.40
Pig No. 281 ..	No eggs	Very numerous	Few	0.3	None	3.6
Pig No. 282 ..	A fair number	Numerous	Very few	17.7	4.0	None
Pig No. 283 ..	Very few	Numerous	Numerous	43.3	42.0	7.0
Pig No. 288 ..	Numerous	Innumerable	Innumerable	318.0	44.0	Innumerable

Group B. No banana stems fed in ration.

Pig No. 284 ..	Numerous	Very numerous	Very numerous	55.9	7.0	0.3
Pig No. 285 ..	Fair number	Numerous	Very few	21.6	4.0	None
Pig No. 286 ..	Numerous	Numerous	Very numerous	31.5	3.0	2.3
Pig No. 287 ..	None	None	None	4.6	2.0	2.3

Group A.

"Pig No. A 281.—No parasites were found in the kidneys. In the perirenal fat there were a few old cysts which were empty of parasites. The liver was normal. A quantity of fine calcareous deposit (sand) was found in the urinary bladder.

Pig No. A 282.—The kidneys were cloudy and mottled on the surface but contained no parasites. One male worm was found encysted in the perirenal fat. The liver was pale and cirrhotic but showed neither abscesses nor parasites.

Pig No. A 283.—The kidneys appeared normal. One male and two female kidney worms were collected from two cysts in the perirenal fat. The liver was normal.

Pig No. A 288.—The kidneys were normal in appearance and contained no parasites. From five cysts in the perirenal fat a total of eight male and five female worms were extracted. There were also two cysts which contained no worms. The liver was normal.

Group B.

Pig No. B 284.—Parasites were present in the pelvis of each kidney. There was one abscess in the right kidney and two abscesses in the left kidney. Old cysts but no parasites were found in the perirenal fat. In the liver there were small abscesses.

Pig No. B 285.—The left kidney was free of parasites but worms and abscesses were found in the right kidney. The liver had two abscesses.

Pig No. B 286.—Parasites were found in the pelvis of each kidney, and in each kidney there was one abscess. Livers were normal. No parasites were found in the perirenal fat though there was evidence of old worm cysts.

Pig No. B 287.—Parasites were present in the pelvis of each kidney, and in each kidney there was an abscess. No parasites found in perirenal fat. The liver contained a number of small abscesses."

This report does not disclose any signs of recent infestation through the skin which causes lesions, oedema or enlargement of superficial lymph glands. The diminishing degree of infestation has insufficient influence on the carcases to warrant any adverse comment on their quality.

Worms were not observed in the kidneys of any of the four pigs of A group at the post-mortem examination on 19th December, 1940, yet three weeks earlier three out of four of these animals were voiding eggs in the urine.

These observations show that all animals in the B group had abscesses in the kidneys and three out of four had abscesses in the liver. The pigs in A group had mostly normal livers and kidneys, and abscesses were absent.

The results indicate that there is no specific in banana stems which has any more anthelmintic properties than are contained in the foods of the alternative ration.

Table IV.

Summary of the Report by the Veterinary Surgeon, Selangor Post-mortem Examinations.

Group A—Banana stems in ration			Group B—No Banana stems in ration		
Pig No.	Liver	Kidney	Pig No.	Liver	Kidney
281 ..	Normal	Parasites absent	284 ..	Abscess	Parasites present with abscesses
282 ..	Pale and cirrhotic	Parasites absent kidneys cloudy and mottled	285 ..	Abscess present	Parasites and abscesses in right kidney
283 ..	Normal	Parasites absent; kidneys normal	286 ..	Normal	Parasites present; abscesses in each kidney
288 ..	Normal	Normal; parasites absent	287 ..	Contained small abscesses	Parasites present; abscesses in each kidney

Although there were indications of a diminishing degree of infestation in both groups of animals, the banana stems would appear to have had a beneficial effect in healing the internal organs of the earlier effects of the parasites.

Comments on the Results of Feeding the Two Rations.

Comparisons of the efficiency of the two rations used are obscured by many influencing factors. Live-weight gains of each pig are recorded in Table V below.

Table V.

Live-weight Gains during the Period of the Experiment.

Group A.

	Wts. on 30.4.40 lbs.	Wts. on 10.12.40 lbs.	Total Gain lbs.	Live-weight gain per day in lbs.
Gilt No. 281	124	248	124	0.556
„ 282	152	285	133	0.596
„ 283	132	267	135	0.605
„ 288	167	302	135	0.605
Total	575	1,102	527	

Group B.

Gilt No. 284	153	328	175	0.785
Male „ 285	149	305	156	0.699
„ „ 286	113	310	197	0.839
„ „ 287	159	304	145	0.650
Total	547	1,247	673	

Figures in Table V show that the pigs in B group, despite the unhealthy condition of their livers and kidneys, put on weight at a much faster rate than the presumably more healthy pigs of A group.

The inclusion of four gilts in A group and three castrated males and one gilt in B group provided this latter pen with an advantage, owing to the tendency of unspayed gilts to lose, for a day or two every three weeks, their appetite during periods of oestrus. The gilt however in group B was the second best feeder of the four pigs.

The albuminoid ratio of the ration fed to the A group was 1 to 6.6 and should have been nearest to standard recommendations for pigs over 120 lbs. in weight, whilst that fed to the B group was 1 to 6.4 and more

suited to pigs approximately 120 lbs. in weight. The inclusion of sweet potato vines and an additional 2 lbs. of groundnut cake to balance the ingredients in B group ration may have provided this pen with proteins of a better quality and generally more suited to pig feeding.

The inference that may be drawn is that the fairly cheap B group ration will produce good live-weight increases when fed to uninfested fatteners of 120 lbs. or more in weight.

Summary.

An experiment was conducted on eight fattening pigs infested with *Stephanurus dentatus*, Deising 1839, the kidney worm, to test the contention of Chinese pig keepers that cooked banana stems in pig rations check the ravages of the pest, or at least ameliorate the effect of the worm on infested pigs.

The experiment confirms, in part, the Chinese pig keepers' belief that cooked banana stems, fed in pig rations, result in a higher percentage of healthy livers and kidneys in the carcases of infested pigs and, in consequence, fewer of these organs are condemned by the Inspector of meat at the abattoirs.

It shows, however, that banana stems possess no more anthelmintic properties for destroying or expelling the parasite from the viscera, than were contained in the alternative ration.

The post mortem examination revealed that the livers and kidneys of the infested pigs, receiving banana stems in the ration, were in a far healthier condition than the same organs in the alternative group fed on a ration containing no banana stems, and suggested also that the parasite had a mature existence of only a few months in the viscera of the host.

Examinations of the urine showed a gradual diminution of the degree of infestation manifested by a steady decline in the number of parasite eggs voided.

As stated in a previous article (1) about six months elapse from the first ingestion of larvae to the excretion of eggs. It will be realized, therefore, that the breeding animals in a herd are most likely to disseminate the parasite. Fatteners, infested when very young under a system of modern rapid feeding, should be approaching slaughter weights when they commence to void eggs.

The experiment indicates that daily sluicing of concrete-floored styes gradually eliminates a moderate degree of infestation of the worm from mature pigs, and suggests that such hygienic methods of maintenance would eventually eradicate the pest from an infested herd.

The rations used were reasonably cheap and were efficient, particularly that containing no banana stems. The pigs made reasonably good live-weight increases despite the fact that they were approaching mature weights and were all infested with the kidney worm.

Acknowledgement.

The writers wish to record their indebtedness to Mr. Rocker, State Veterinary Surgeon, Selangor, for examination and reports on the samples of urine and for the post-mortem reports on the carcases and viscera.

Reference.

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CENTRAL EXPERIMENT STATION, SERDANG.

Conditions During and After Enemy Occupation.

Compiled from information obtained from the Staff of the Station.

Introduction.

Soon after Kuala Lumpur was occupied by the Japanese in January, 1942, the Central Experiment Station was re-opened with a skeleton staff and labour force under the charge of one of the Station Asiatic Officers. The main activities during the early stages of the occupation were the cultivation of vacant areas for the planting of foodcrops and fodders, with the control of undergrowth and weeding of permanent crop areas. No palm oil, tea or coffee were produced owing to the factories having been put out of commission by the European Officers before evacuation, in accordance with the scorched earth policy. In July a Danish planter took charge of the Station, but towards the end of 1942 he was superseded by two Japanese. From this period onwards the Station was run according to Japanese methods. Changes in the Japanese personnel were frequent, and as each had different ideas and policy the working conditions became intolerable. However, the work of foodcrop cultivation proceeded sporadically until about the latter part of 1944 when the food situation became more acute. the health of the labourers was badly affected, and the Japanese personnel were harassed by guerillas. Conditions afterwards fast deteriorated until finally, from the early part of 1945 until the liberation, work was almost at a stand-still.

Conditions During Enemy Occupation.

Established pre-war experiments were not continued by the Japanese, although the relative records were left in the office and some were recovered on re-occupation. The Japanese, however, did inaugurate some experiments and trials along their own lines of thought, mainly in connexion with foodcrops and fibres. They kept their own records in their own language, and these have not been discovered.

The main policy during the occupation was to increase food supplies; all other work was subordinated to this purpose and in general the permanent crops were neglected. Until the machinery was repaired late in 1942 harvesting of the oil palm fruit bunches and tea plucking were not undertaken. Later, all the tall oil palms were abandoned and little harvesting of the crop took place. The small amount of oil produced was supplied to the labourers and staff for edible and lighting purposes, while the balance was sent to Headquarters for soap production and axle-grease manufacture. Only two tea fields were properly pruned, the other being roughly slashed, and the tea areas were not manured. Later, plucking and manufacture were contracted to a Chinese, who produced mainly China tea; only a small quantity of black tea was made. In order to obtain high returns, very heavy plucking was adopted without any consideration for the welfare of the bushes.

Other permanent crops were completely abandoned except where the produce was required for local use, such as rope and twine from the manila hemp, *Musa textilis*, and coffee, *Coffea robusta* and *C. liberica* for local consumption. The areas of *Derris elliptica* were removed to make way for foodcrop cultivation; similarly with new pastures and fodder demonstration plots. For unknown reasons, the selected derris clones in the nursery area were left untouched, although a Japanese planting company in Sungei Buloh purchased most of the material from other parts of the plantation for planting purposes.

Fruit areas were completely neglected. The large stock of budded plants which was prepared for distribution in 1942 was sold or disposed of as free gifts to Japanese visitors.

The General Nursery was used for the cultivation of vegetables and the production of seed. Attempts to introduce vegetables and other crops by the use of seed imported from Japan invariably met with failure. It is unfortunate that a large number of minor economic crops growing in the nurseries were destroyed. (*vide* list in Appendix I).

Towards the end of 1944 the Japanese launched a scheme to improve the food situation by allotting about 75 acres of reserve jungle land in the north-eastern end of the Station to the Chairman of the Overseas Chinese Association, Serdang. The area was to be divided into 1-acre blocks for planting foodcrops, and to be alienated to needy Chinese in Serdang. The terms of the contract were that a certain percentage of the crop should be delivered to the Station office, and all felled timber was to be supplied to the Station for building material or fuel. One crop of tapioca, *Manihot utilissima*, was planted, but before it could be harvested, the Japanese capitulated.

Condition of the Station on the Arrival of the British Military Administration. September, 1945.

On entering the Station the appearance was one of neglect and destruction. The oil palm avenues were obstructed by unpruned leaves, which hung down into the road. These leaves were hacked out of the way by a soldier sitting on top of the leading truck of the re-occupying British troops. The road verges were overgrown with lalang, (*Imperata cylindrica*), and sendudok or Straits Rhododendron (*Melastoma malabathricum*) bushes abounded, covering most of the drains.

In the more open and less shaded areas lalang, sendudok, (occurring in large areas often 6 to 12 ft. high) and the sensitive weed, (*Mimosa pudica*) were predominant.

The drainage system had been allowed to deteriorate, and flooding was severe in the low-lying areas. Some of this flooding was aggravated by the damming of some of the larger drains to form fish ponds.

When clearing the drains, the original line was most easily determined by following the more luxuriant growth of sendudok, which growing from the bottom and sides of the old drains overtopped the surrounding secondary jungle growth. Perhaps this was due to the more fertile soil within the drains which, owing to earlier neglect, were silted up with the eroded top soil from areas at a higher level.

The tea areas were badly neglected, although some sporadic work had been done on some of the fields. Surprisingly healthy tea was found under luxuriant secondary jungle growths. The healthiest and the more numerous survivors were found where the shade trees had survived, and this was particularly so under the *Gliricidia maculata* shade. Ganoderma root disease of tea bushes appeared to have spread in annular areas from dead and presumably diseased *Albizzia moluccana* shade trees. It was noticeable in Field 16 that the healthiest tea bushes were towards the top of the slope, although the area was completely over-grown with weeds. It was thought that this might be due to the better drainage at the higher levels of the Field.

The oil palm areas were neglected and were covered with a heavy undergrowth of sendudok, and climbing ferns. The young palms in Field 4 had been harvested for a time by the Japanese, and although the ground cover was almost entirely sheet lalang the palms had survived and seemed fairly healthy. The first generation of oil palms in Field 3 which had been bred from selected palms producing oil having a high carotene content were only distinguishable on the side of the track which had been re-opened up to the pumping station. The rest of the palms were completely overgrown by high secondary jungle growth.

Pasture areas were badly neglected and overgrown with lalang and weeds, especially sendudok and sensitive weed. Small areas had been grazed to some extent, most likely by cattle and goats owned by the plantation labour and the local squatters. These poor emaciated animals wandered at will over the old experiment areas.

In areas which had been used for foodcrops such as tapioca, sweet potato and maize, and later had been allowed to revert to natural growths, the predominant weed was lalang with the lines of the old drains marked by a vigorous stand of sendudok.

Coffee had survived well, particularly in the shaded areas, but the cinnamon trees in competition with Gleichenia fern and sendudok were moribund, and it seemed doubtful if they would survive. The same observation applied to cloves, which were heavily overgrown with *Passiflora foetida*; as they were defoliated, and manifested much "die back." Manila hemp, (*Musa textilis*), seemed to have competed reasonably well with secondary growths in spite of obvious neglect, particularly where it was inter-planted with *Gliricidia maculata*. Gambier, (*Uncaria gambir*), had survived but was weakly. *Derris elliptica* was almost completely invisible under secondary jungle growth but seemed healthy in the areas where it could be found, which was not easy owing to the thick overgrowth. The jelutong, (*Dyera costulata*), and rubber, (*Hevea brasiliensis*), appeared healthy and showed no obvious signs of disease.

The bungalows, laboratories, oil palm and tea factories and the School of Agriculture buildings had all been badly neglected, damaged, and looted a second time; this occurred during the period between the Japanese leaving and the arrival of the re-occupying forces. Most tools, small pieces of machinery,

laboratory equipment, furniture, books and records were missing; even fastenings and electrical fittings were torn out of the woodwork or broken. The scattered remains of broken wash-hand basins, toilet fittings and furniture demonstrated the depredations of the looters. During the Japanese time the experimental padi tanks, which were used by the Entomologist for work on padi stem-borers had been allowed to fall into disrepair and all piping, fittings, posts and all the wire netting associated with this installation were looted.

Conditions in July, 1946.

Oil Palms.—The old palms presented a very dismal picture of ill-health with leaves hanging forlornly down showing a preponderance of bronzed foliage and scanty, small, poorly formed fruit bunches. Even 6 months after slashing the heavy undergrowth and pruning the dead leaves the palms appear to be making but slow recovery, flowering and fruiting being poor; they can be classed as moribund. It would appear that on the poor hilly land of the plantation the cessation of annual manuring with the routine checking of excessive undergrowth has had a disastrous effect, probably due to the fact that most of the available food supplies had been absorbed by the competitive undergrowth, resulting in almost complete starvation of the palms.

One interesting conjecture advanced regarding the lack of fruit which has been noted on many estates throughout Malaya is that the unpruned leaves and high secondary growths have prevented the natural spread of wind-borne pollen from the isolated male inflorescences throughout the fields onto isolated receptive female inflorescences.

In comparison with the old areas, palms planted in 1939-41 have survived even more severe competition without undue harm. After the undergrowth and lalang were removed they commenced flowering and setting fruit normally.

Fruit.—In 1940, 3 acres of mixed fruit trees were planted in a small clearing in the jungle reserve; three different methods were adopted in planting and clearing these areas. While not strictly relevant to the subject, these methods are described in detail, and the conditions resulting from years of neglect are discussed in relation to them. In Block 1 the jungle was felled and burnt. Firstly tapioca was grown, and, after six months, fruit trees and coffee were planted amongst the growing crop. No weeding was done and light secondary jungle growth was allowed to develop. This method is one commonly adopted by Malays in establishing fruits in the kampongs.

Block 2 was opened up according to estate practice as follows. The jungle was felled and burnt; the land was then stumped and clean-cleared, and contour pitted to prevent any soil erosion. Planting holes 2 ft. x 2 ft. were dug and filled with top soil mixed with organic matter in the form of grass and weeds. After settling, the fruit trees were planted and the whole area sown with a mixed cover crop of *Centrosema pubescens* and *Calopogonium mucunoides*. Top shade was provided for the young plants where necessary and each had a ring of *Crotalaria anagyroides* planted in a circle about 1 ft. from the plant. Regular "ring weeding" was carried out. Fruit trees only were planted in this block.

In Block 3, the undergrowth and all small jungle trees were removed by cutting to ground level, and the large trees thinned out sufficiently to allow of planting and to permit high light to reach the young plants. Both fruit and coffee were planted, the former in holes 2 ft. x 2 ft. and the latter in holes 1 ft. x 1 ft. As the fruit trees developed, the jungle trees were gradually removed. Strip weeding was carried out where necessary. In order to minimize root competition by the jungle species, trenches were cut 3 ft. from the trees and 3 ft. deep over half the experimental area. The trenches were then re-filled with soil. The object of re-filling the trenches was to encourage the tree roots to grow into the trenches and not burrow underneath. Every 6 months these trenches were cleaned out, the tree roots destroyed and afterwards re-filled.

The whole of this 3 acre fruit area was abandoned by the Japanese in January, 1942, and rehabilitation could not be undertaken until the middle of July, 1946, during which time the jungle had almost retaken possession. On re-opening the area the following conditions were found.

Block 1 was a mass of sheet lalang and very few fruit trees or coffee bushes had survived.

Block 2 was still in fair condition; the cover crop had maintained a fair control of the ground surface; lalang was sparse, and practically all the fruit trees had survived. Rambutan trees, (*Nephelium lappaceum*), had made excellent growth and were carrying a good crop of fruit. Some of these trees are between 25 ft. and 30 ft. in height with an equal diameter of spread. Durians, (*Durio zibethinus*), had grown fairly well; one tree was outstanding. Mangosteens, (*Garcinia Mangostana*), however, had made very slow growth. Minor fruits such as soursop, (*Annona muricata*), bullock heart, (*Annona reticulata*), and custard apple, (*Annona squamosa*), which were planted in the middle of 1940 and early 1941, had mostly died out.

In Block 3 nearly all the fruit trees had survived in spite of being completely overtopped and confined by the jungle trees. All the trees were naturally very drawn with few side branches. Rambutans had made fair growth; durians had done well, and so had the mangosteens. The other fruits had suffered similarly to those in Block 2. The coffee was very 'leggy' and almost moribund.

The harmful effect of taking off foodcrops, especially tapioca, in establishing a fruit orchard has been clearly shown in this experiment. Normal care and maintenance would have reduced this harmful effect but neglect had made matters worse. The area will be costly to work into condition again and much fertility has been lost by exposure, leaching and erosion.

It is considered that the method described in Block 3 would have proved very successful if the jungle trees had been controlled by cutting back as the fruit trees developed. The ease with which the young trees were established is a point not to be overlooked. This area is completely free from lalang.

The hardiness of the rambutan has also been demonstrated on this area and on other parts of the plantation. This is the outstanding high-grade fruit tree that shows no ill-effects from neglect. Fruit trees which suffered most were

the citrus in Field 17 and in the fruit nursery. Established durians, (*Durio zibethinus*), and pulasans, (*Nephelium mutabile*), have all survived. Avocado pears, (*Persea gratissima*), show much die-back, while minor fruits such as chempedak, (*Artocarpus polyphema*), bread fruit, (*Artocarpus integrifolia*), mango, (*Mangifera indica*), and machang, (*Mangifera foetida*), are in fair condition but there is much diseased wood in evidence and poor quality fruits are being produced.

The budwood nurseries had not been pruned since 1942 and had grown into young forests. Excellent budding material of rambutan, pulasan and durian is now being produced following coppicing.

Coffee.—An article* published in 1941 described a mulching experiment, and gave the results of the first two years. Mulching with cut grass at the rate of 20 tons per acre had given increased yields amounting to 127 per cent. for Liberian and 59 per cent. for Robusta in the second year.

In July 1946 the plots were examined; after 4 years neglect the mulched plots were very clearly distinguishable from the unmulched ones, so much so, that there was no need to refer to the lay-out plan. The coffee bushes in the unmulched plots were in poor health, the leaves were scanty and very yellow and fruiting was meagre. In the mulched plots the bushes were still very green, full of vigour, flowering and fruiting well; the residual effects of the treatment after 4 years were remarkable. There was of course no sign of any mulch, but the surface soil was not consolidated or eroded as in the unmulched area, partly due to the fact that the coffee bushes themselves now gave considerable protection from the sun and heavy, beating rain.

From these results we have evidence not only of the immediate value of coarse, unfermented, organic material to conserve the soil and its moisture and to act as manure but also of the very marked lasting value of such material on a permanent crop such as coffee.

Effect of Shade.—Throughout the plantation the value of light top shade such as produced by *Albizzia moluccana* was well in evidence. Crops showing such benefit were tea seed bearers which showed darker green foliage and suffered less from die-back. Fodder grasses grown under shade showed very marked improvement in growth and palatability when compared with plants growing in the open. Coffee bushes under the saga tree (*Adenanthera pavonina*), although neglected for 4½ years, were in fair condition, while those growing in unshaded plots had mostly died out. This beneficial effect of light shade can be attributed to:

(1) Partial suppression of lalang and secondary jungle growth.

(2) Maintenance of a higher moisture content and lower temperature of the soil resulting in a slower breaking down of organic matter which, in turn, results in retention of fertility and has a beneficial effect on soil structure.

(3) Value of the leaf-fall as a mulch and fixation of nitrogen by the roots.

* *Malayan Agricultural Journal*, Vol. XXIX, No. 2, February, 1941.

In connexion with shade trees, one ill effect of *Albizzia moluccana* planted with tea has been the large areas attacked by the red-root disease fungus (*Ganoderma pseudoferreum*). Whether the presence of heavy undergrowth and the neglect of the bushes had any effect on the occurrence of this disease or whether it would have occurred under normal conditions of maintenance is difficult to determine, but the inference remains that *Albizzia moluccana* should be avoided in Malaya as a shade tree for tea.

Appendix I.

List Showing Some of the Crops Lost During the Japanese Occupation.

FOOD CROPS.

Collections of *Alocasia* and *Colocasia.*

Greater and Lesser Yams. *Dioscorea alata* and *D. esculenta.*

Soya bean varieties, *Glycine hispida,* introduced from Java.

Sweet potatoes, *Ipomoea batatas.* A large collection of named varieties, both local and introduced.

Tapioca, *Manihot utilissima.* A large collection of local and introduced 'Sweet', 'Bitter' and early maturing sweet varieties.

Arrowroot, *Maranta arundinacea.*

Jerusalem artichoke, *Helianthus tuberosus.*

Sugar cane, *Saccharum officinarum.* Collection of named varieties, mainly from Java.

Bambara groundnut, *Voandzeia subterranea.*

Maize, *Zea Mays.* Several varieties representative of the Flint, Dent and Sweet Corns.

FRUITS.

Water Lemons, *Passiflora laurifolia.*

Grenadilla, *Passiflora quadrangularis.*

ESSENTIAL OILS.

Patchouli, *Pogostemon Cablin.*

Lemon Grass, *Cymbopogon citratus.*

FIBRE PLANTS.

Sisal hemp, *Agave sisalana.*

Mauritius hemp, *Furcraea cubensis.*

Roselle fibre, *Hibiscus sabdariffa.*

Bimlipatam jute, *Hibiscus cannabinus.*

SPICES.

Turmeric, *Curcuma domestica.*

Pepper, *Piper nigrum.*

Ginger, *Zingiber officinale.*

COVER CROPS.

Centrosema plumieri, Desmodium gyroides, D. polycarpum, Indigofera endecaphylla, Pueraria sp., and *Dolichos Hosei, D. ovalifolium, Tephrosia purpurea, T. Vogelii, Vigna marina.*

DYESTUFFS.

Indigo, *Indigofera arrecta.*

FODDER GRASSES.

Rhodes, *Chloris gayana.*
Australia Blue couch, *Digitaria didactyla.*
Dallis, *Paspalum dilatatum.*
Buffal, *Reana luxurians.*
Zoysia pungens.
Urochloa brachyura.
Stenotaphrum secundatum.
Apocopsis siamensis.
Amphilopsis glubra.
Setaria rabiginosa.
Paspalum orbiculare.

MISCELLANEOUS CROPS.

Tobacco, *Nicotiana tabacum.*

Received for publication, 3rd January, 1947.

"TEMBAKAU RACHIT"

BY

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During the second half of 1946, increased interest was taken by Javanese small-holders in the Kuala Langat District of Selangor in the cultivation and preparation of tobacco for local consumption. *Tembakau rachit* is a finely sliced tobacco made for smoking in *rokok puchok*, a prepared tobacco, using the dried immature leaves of the nipah palm, *Nipah fruticans*, as wrappers. The tobacco plants are grown on peat, which after burning is very suitable for tobacco cultivation, and, providing careful attention is given during the growing period, satisfactory yields are obtained.

There are two types of tobacco commonly grown in the Kuala Langat District:—

(a) plants having oval leaves with a wrinkled surface when fully developed and dark green in colour, and

(b) leaves elongated and tapering towards the tips and light green in colour.

The following notes describe the methods used in harvesting, fermentation, and preparation of the leaves for the production of tobacco by the Javanese growers at Kuala Langat.

About 18 to 20 leaves only are allowed to develop on each plant and at this stage the growing point is cut off. There are three stages of harvesting, each producing a different kind of tobacco. The first 6 to 7 leaves are harvested when the plant is about 2½ months old and the leaves have begun to yellow but have not withered. The lower 2 or 3 leaves at the base of the plant are discarded, but the remaining 4 leaves are dried in the sun and sold as chewing tobacco. The second harvest is undertaken a week later and consists of the removal of a further 4 to 5 leaves. The final harvest follows a week later when all leaves remaining on the plant are removed. These leaves produce the finest quality tobacco. Thus in about 3 months from planting harvesting is completed. It is estimated that the crop so obtained gives an average yield of prepared *tembakau rachit* of about 4 piculs per acre.

After harvesting is finished the plants are usually cut back to within 6 ins. from ground level and allowed to throw out secondary shoots. A yield of slightly more than half that obtained from the main crop is secured, i.e. slightly over 2 piculs per acre of prepared tobacco.

Harvesting is usually performed in the morning, and the leaves are spread on mats under the house unexposed to the sun. Any moisture on the leaves will have evaporated by the evening. The leaves are then stacked in piles, sometimes wrapped in coconut fronds, and stored for three days

in a cool dry situation, during which time the temperature will have risen and fermentation taken place. The leaves then show an almost uniform yellow colour as a result of the process of fermentation. On the fourth day the leaves are ready for slicing. Previous to this being undertaken the mid-ribs of the leaves are torn off up to about three-quarters of their length from the base. The leaves are then piled up, over-lapping one another so that the tip of the bottom leaf extends out of the pile. By this means, when the leaves are rolled up from the base for slicing, handling is facilitated. The number of leaves placed in each roll is sufficient to form a bundle convenient to hold in the hand. The rolled leaves are now ready for slicing. The bundle is next held in the hand and pressed on the platform of the slicing apparatus. This consists of a sloping wooden platform 4 ins. wide and about 1 ft. long, nailed at each end to a wooden block which is held in position by two uprights at the sides wedged in holes made on a bench which forms the seat of the slicer. A rattan band is tied round the top of the uprights in order to keep them in position. The bundle of tobacco leaves is then sliced with a very sharp knife. It requires a lot of practice before competence in slicing is attained. Smokers prefer the tobacco not too finely sliced as the flavour is then more bitter than when it is finely cut. Bamboo slats, about 5 ft. long and 3 ft. wide are used for drying the tobacco, which, after slicing, is spread on the slats as thinly as possible to ensure uniform drying and allowed to dry in the sun for three days. In order to hasten drying the slats are turned over completely every afternoon. The tobacco is very brittle at this stage and the turning is performed by placing another slat on top of the tobacco and turning the two slats upside down and then removing the one which is on top but was originally at the bottom. On the first night the slats on which the tobacco is spread are allowed to remain in the open air, unless there is rain, until as late as 11 p.m., and on the second night until about 10 p.m. This is done in order to allow the dew to collect on the tobacco and by so doing impart a shiny red colour to the finished product. On the evening of the third day the tobacco will have become soft, when it is ready for storing and finally smoking.

Before storing, the tobacco has to be compressed. This is done by placing the tobacco on mats direct from the slats. The mats are folded lengthwise over the tobacco and the whole is then trampled by foot. The tobacco is then folded into bundles of suitable sizes and wrapped in paper or dried banana leaves and stored in wooden boxes. It is considered that the longer the tobacco is stored the more fragrant it becomes.

Received for publication, 16th January, 1947.

EMERGENCY FOOD PRODUCTION

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E. J. H. BERWICK,

Agricultural Liaison Officer.

In March, 1946, a Food Executive Committee appointed by the British Military Administration set up a Short Term Food Production organisation to carry out direct production of food stuffs in order to augment the country's supplies. This short-term food-drive was separate from long term food production in Malaya, and over-rode any long term considerations. The crops grown were those other than wet padi which remained the responsibility of the Agricultural Department, the land being any suitable area felled by the Japanese and any State or Forest Reserve Land which could be made appropriately available. The general policy was to clear the land by means of mechanical equipment, in order to economise in labour, and to use Japanese Surrendered Personnel. These areas, known as Government Farms, were then either planted by the Government itself or handed over to settlers. It was clear from the beginning that, owing to a world shortage of supplies, equipment and stores, the task would be a difficult one. In spite of this, progress was made, and at the end of February, 1947, 5,777 acres of land on such farms had been cleared.

As regards mechanical equipment, tractors were hired from the Army in Malaya, and, towards the end of the year, more were obtained from the American Army in Manila. All are not yet in working order as many of those obtained from Manila arrived late in 1946 and have not yet been serviced.

The supply of agricultural implements also presented a difficulty as most firms in the United Kingdom appeared to have none available for export. Here too, some were hired from the Army, and it was possible to obtain some cultivator-units and disc-drills from Australia.

With the more settled conditions prevailing at the end of February, 1947, the Government felt that the time was opportune for achieving food production on a wider scale than that previously possible and recognised that the agricultural population itself was the best source of such increased production. As the Department of Agriculture had now been largely re-staffed with its permanent officers, it was able to undertake, in addition to its substantive duties, the extra work of administering this scheme for increased food production. To this end the Government has allocated responsibility for all food production in Malaya to the Director of Agriculture from March 1st, 1947. The " Short Term Food Production " organisation has accordingly now been absorbed and emergency food production now forms an important branch of the activities of the Department of Agriculture.

General Policy.

In view of the fact that imports of cereals are likely to be in short supply in the latter part of 1947, first priority is being given to the growing of padi, maize and groundnuts, in the present padi off-season, and every effort is being made to ensure an increased cultivated acreage of wet padi for the 1947/48 crop. Off-season foodcrop cultivation, moreover, when situated in wet padi areas, will be so timed as not to interfere with the planting of the main padi crop. The planting of extra food crops will be encouraged through the medium of propaganda, the provision of land on attractive terms, the supply of seeds and tools, and, where desirable, the provision by the Government of grants or loans. If growers are not forthcoming, contract labour will be employed. The policy with regard to the employment of mechanical equipment for the production of food has changed from the previous one of accepting mechanisation as a means of food production on a large scale to one of investigating by experiments the possibilities of using mechanisation in both dry and wet padi conditions. The work to be done falls into four divisions: (a) the growing of off-season crops, (b) increasing the area under wet padi, (c) the growing of crops with contract labour, mainly on Government Farms, and (d) the carrying out of rapid and accurate investigations into the possibilities of mechanised production of food.

Off-season Crops.

The first step in increasing the production of off-season crops was the guaranteeing of prices for the most important of the rice substitutes, and prices which will continue until the end of 1947 were accordingly gazetted:—maize, $15 per picul; groundnuts, $20 per picul; and arrangements were made within each State or Settlement for all growers to be informed of these prices by State Agricultural Officers. At the same time, further encouragement has been given to the production of these crops by propaganda by all appropriate Departments. It has been too late to do much in this direction in most districts, but large acreage will be planted in the Tanjong Karang area of Selangor and in the riverine districts in Kelantan; while in Malacca and Province Wellesley, where cultivation of crops in the off-season is a normal agricultural practice, a considerable increase in the area of wet padi land planted with off-season crops is expected.

Padi Schemes.

As a long term policy, the Drainage and Irrigation Department with other Departments, had in hand the development of large irrigation schemes in many parts of the Peninsula, for example, at Sungei Manik and Changkat Jong in Perak, at Tanjong Karang and Panjang Bedina in Selangor, and at Endau and Kahang in Johore. Attempts are being made to increase the acreage under production in these areas and also to improve water conditions in many of the smaller wet padi lands, which had, in most cases, been neglected during the Japanese occupation. This, it is hoped, will have

the effect not only of increasing the total acreage planted with wet padi in the 1947/48 season, but also of increasing the yields in many fields which gave poor or mediocre returns last season. Agricultural Officers of the Field Branch have been examining these smaller padi areas to see whether improvements may be made, and in the large States, such as Perak, work mainly in the mature of the building of temporary dams and the digging of drainage channels, is necessary on 61 of these areas, comprising 11,862 acres. These proposals are then discussed with officers of the Drainage and Irrigation Department and Land Offices and a general programme prepared so that co-operation between all Departments will ensure that the funds available are used to the best advantage. Most of the constructional work is being done by hand, generally on contract, but, where feasible, mechanical equipment is used, for example, in constructing access roads to Sungei Manik and in repairing the bund along the Malacca River.

Plans are also being made to organise loans to padi planters where they are considered to be necessary. In Kedah it is hoped to make a loan of $500,000 available for the supply of bat guano. Similarly it is hoped to provide long term loans for cultivators in Pahang, to enable them to replace their buffaloes, depleted during the past four years, which are necessary for the cultivation of deep padi areas.

Government Farms.

As a preliminary to making decisions on the future policy with regard to these farms, a Technical Committee, comprising the Chief Research Officer, the Chief Field Officer and the Senior Agriculturist, inspected all Government Farms and submitted a report to the Director of Agriculture. The general policy recommended was that, wherever possible, a rice substitute crop, generally either groundnuts or maize, should be obtained immediately, followed by dry padi in August, but certain areas of low fertility, or where soil erosion is serious, are to be planted with cover crops. Further stumping by means of bulldozers, which generally results in the loss of the top soil, will cease, except on those farms where Government is already bound by contract to stump certain fields.

At Ulu Gali in Pahang it was recommended that the farm should be converted into a wet padi area. The Drainage and Irrigation Department was consulted and a scheme designed on which work has already started. Here its seems likely that a sufficient number of settlers will be forthcoming. On other farms situated on State land, certain areas already cleared will be handed over to settlers, generally with two-year tenure, for cultivation of dry land crops.

Investigations with Mechanical Equipment.

Investigations into the mechanical production of padi in both wet and dry conditions are being started, the former in Lower Perak in Stage IV of the Sungei Manik Irrigation Scheme, and the latter at the Sungei Buloh Farm, near Kuala Lumpur. The soil in Sungei Manik, which contains a high proportion of peat, is by no means ideal for mechanical cultivation,

but it is typical of much of the land which is likely to be opened by the Drainage and Irrigation Department in the future, for instance in the 166,000 acre Perak River scheme. Most of the existing padi Irrigation Schemes are designed so that one cubic foot of water irrigates 50 acres; this is probably insufficient for mechanical cultivation, so that mechanical cultivation, if practicable at all on a large scale in Malaya, is likely to be confined to new areas. It will be seen that this revised policy will not require as large a number of heavy tractors as the previous one and arrangements have already been made to return those hired from the Army, on which considerable rent was being paid. As soon as it has been ascertained how many tractors may usefully be employed by the Department of Agriculture or by the Drainage and Irrigation Department on schemes of the type outlined above, the remainder will be taken up by other Government Departments to help in the general rehabilitation of Malaya.

Organisation.

While the administration of the food production drive is the responsibility of the Director of Agriculture, for purposes of efficiency and speed the decentralisation of administration and execution is being effected in the respective States and Settlements through the State Agricultural Officers They will give technical advice on all matters required on the part of growers and will assist in the supply of seeds, tools, grants, loans, and other facilities in connection with land occupation. The Short Term Food Production organisation has thus become absorbed in the Department of Agriculture. The Farm Managers are now titled Food Production Officers and come under the immediate administration of State Agricultural Officers. To render assistance in administrative matters, and for the purpose of co-ordinating schemes, an Agricultural Officer on the permanent establishment has been transferred from the Field Branch with the title of Agricultural Liaison Officer.

Summary.

The summary of the present position is that, on the instructions of H.E. the Governor, the Short Term Food Production organisation has been absorbed by the Agricultural Department. In view of the continuing shortage of cereals both locally, and in the world in general, as many off-season crops of rice-substitutes as possible are being planted and steps are to be taken to increase the acreage and yield in the coming 1947-1948 wet padi season. The personnel, funds, and equipment of the former Short Term Food Production organisation will now be used for these purposes. State and Settlement Agricultural Officers will now be responsible to the Director of Agriculture for all aspects of the food production drive in their States and Settlements. These aspects may in conclusion be divided into four parts:—

1. the encouragement of the planting of off-season padi substitute crops, such as maize, groundnuts, and cow peas;

2. the accelerated settlement of new padi areas and, in co-operation with the Drainage and Irrigation Department, the improvement of water conditions in existing ones so as to increase both the total acreage under wet padi and average future yields.
3. the production of padi and padi substitute crops, on such areas of the Government Farms as are considered likely to be profitable, both by mechanical and hand labour;
4. investigations into the possibilities of the use of mechanical equipment in the production of padi grown under both wet and dry conditions.

Received for publication, 21st April, 1947.

Selected Articles.

THE FOOD AND AGRICULTURE ORGANISATION*

Relatively little publicity has been given in the Press or elsewhere to the activities of the Food and Agriculture Organisation, though from the various reports that it has issued a great deal of essential preliminary work has evidently been accomplished. A staff of highly competent experts has been temporarily on loan from Government departments and other international bodies for the purpose, though now a nucleus of permanent personnel is established, to which recruitment is to be made on as broad a geographical basis as possible. At the time of its inauguration in November 1945, responsibility for dealing with the immediate post-war world shortage of food was in the hands of international organisations such as the United Nations Relief and Rehabilitation Administration, the Combined Food Board and the Food and Agriculture Sub-committee. By the time that these bodies were due to go out of existence under the arrangements already made, it was hoped that the worst of the food shortage would be over, and that the new authority would start to develop its plan under conditions approximating to those of 1939. Its first task was, therefore, to assess the pre-war position in as many countries as possible as a guide to working out future policies. During the winter of 1945-46, however, serious deterioration in the world's food supplies set in, and following an appeal for help, the Director-General agreed that the Food and Agriculture Organisation should undertake responsibility for relieving the situation. A special meeting was called at Washington in May, 1946, at which recommendations were made to Governments as to the best use of the 1946 harvest and the ways in which still larger harvests could be secured in 1947. Allocation of foodstuffs, based on information and statistics provided by the Organisation, was delegated to a new agency, the International Emergency Food Council. An inquiry was then called for to ascertain the adequacy of existing international institutions to meet long-term problems of production, consumption and distribution, including surpluses.

Two important publications were the outcome of this meeting. "World Food Survey" and "Proposals for a World Food Board"†. The first is a study of the pre-war food consumption figures for seventy countries, comprising 90 per cent. of the world's population. It includes targets drawn up by nutrition experts with the view of providing everyone

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* *Nature*. Vol. 159, No. 4033, February 15, 1947.

† Food and Agriculture Organisation of the United Nations. First Annual Report of the Director-General to the F.A.O. Conference. Pp. iv + 45.
World Food Survey. Pp. 39.
Proposals for a World Food Board. Prepared for submission to the Second Session of the Conference of the Food and Agriculture Organisation, Copenhagen, Denmark, 2 September, 1946, Pp. iii + 12.
(Washington, D.C.: U.N. Food and Agriculture Organisation, 1946).

with an adequate balanced diet, together with a budget of world requirements in 1960 if such targets are to be reached, due allowance being made for population increase in the meantime. The figures are inevitably incomplete, but are probably accurate to within 5 per cent. for countries with a high calorie intake and 10 per cent. for areas where the consumption is low. The extent of the malnutrition can be estimated from the finding that more than half the world's population had a pre-war calorie intake of only 2,250 a head a day; less than one third had available 2,750 or more calories. The deficiency was greatest in Central America and most of Asia, whereas the high-calorie groups occurred chiefly in North America and European countries; though it is realized that average figures inevitably conceal sharp variations owing to uneven distribution.

Further, the proportion of the various types of food yielding a similar total in calories may depend on national diet. Denmark and New Zealand, for example, are both countries with a high average food intake and a well-balanced diet; but though their consumption of cereals was equally low and that of milk equally high, wide differences were shown in regard to intake of animal protein and fat. Abundance of supplies and adequate purchasing power, however, resulted in a satisfactory diet in each case. In some of the countries in the low-calorie group, such as Java, the malnutrition was worse than the total figures suggest, since the proportion of cereals consumed was too high and the protein and fat consumption quite inadequate to maintain health. As a basis on which to work, estimates of the various foods needed by the world in 1960, if the calorie intake per head per day in the low-calorie groups is to be raised to 2,550-2,2,650, have been put forward by nutrition experts. The proportions of the different types of food comprising this total are roughly indicated, as the primary aim is to improve the balance between the various components of the unsatisfactory diets rather than attempt to alter the habits of any country.

For such a target to be achieved, production will need to be raised considerably, though the actual increases required vary widely with the different commodities, ranging from 12 and 21 per cent. respectively in the case of sugar and cereals, to 100 per cent. for milk and 163 per cent. for fruit and vegetables. Increased production in its turn implies improvement in agricultural methods. More fertilizers and machinery will be wanted, irrigation and drainage schemes must be carried out, and deteriorated areas reclaimed. The application of science to agriculture, however, does not necessarily provide the solution; it may even create its own problems, as, for example, the accumulation of local surpluses, so that proper distribution becomes the major difficulty. Economic and social changes are also called for, such as the large-scale development of industry and trade, educational services, and some machinery for supplying credit to farmers. Positive action on an international scale to plan and organise production, marketing and finance would be needed to implement these recommendations, and in a further report the formation of a World Food Board was proposed. This

body was envisaged as a central authority, empowered to hold reserve stocks of the more important commodities, to provide funds for financing the disposal of surpluses, and to co-operate with organisations concerned with international credits for industrial and agricultural development. Later discussion, however, rejected the scheme in this form, and proposals of an alternative nature were put forward.

In September 1946, the second meeting of the Food and Agriculture Organisation was held at Copenhagen. Five new member nations were admitted, bringing the total to forty-seven. The principal concerns of this conference were to appraise the Organisation's work during the previous months and to make a start with the major problems of a long-range world food policy. One special feature was the approval of the report of the Commission to Greece, which at the request of the Greek Government had carried out a survey of the agriculture, forestry and fisheries of the country, and made recommendations for future improvements and development. It was the first of this type of enterprise undertaken by the Organisation, though the extension of such services to other countries, as requested, is likely to be a feature of its activities in the future.

Though the Copenhagen conference did not lose sight of the fact that there is still an urgent need for maximum food production, avoidance of loss during storage and continued controls and economies in the use of all basic foods, the chief interest was naturally centered on the long-range programme. For this purpose a Preparatory Commission was set up to develop the proposals for inter-governmental action to prevent the occurrence of both shortages and surpluses of food and other agricultural products, and, in particular, to consider the proposal already put forward for a World Food Board. The Commission consisted of representatives from sixteen member nations, three non-member nations with major or specialized food resources also being asked to participate. In addition, co-operation was invited from various inter-governmental organisations connected with trade, health and finance. The principal findings of this Commission have now been announced. Though entirely in agreement with the essential features of the plan put forward by Sir John Boyd Orr in his proposal for a World Food Board, it has recommended that, in place of an international authority itself holding reserves of food and purchasing power, co-operation should be worked out between the nations on a voluntary basis. Reserves of food should be built up nationally, but they should be operated inter-nationally; orderly marketing policies should be framed and price-levels for a term of years fixed by international agreement. A World Food Council representing eighteen nations is suggested, which would work in close liason with the Food and Agriculture Organisation, and meeting if required at intervals between the conferences of the latter. The proposals fit into the general scheme of the United Nations Organisation, and allow of close co-operation with existing agencies, among which the International Bank may be specially mentioned.

A policy of expansion is the keynote of the programmes suggested, both as regards food production and the development of industry and social services in rural areas. The carrying out of the proposals, however, depends on the various Governments concerned; for they will have to provide the necessary facilities and co-operation if the aims of the Food and Agriculture Organisation are to be realized, and adequate food, at a fair price, be made available to all. The scientific and technical views, based on a critical examination of the data available, have been set out; it is now the task of the statesmen of the world to frame their policies to fit the facts of the situation.

RUBBER*

Brazilian Exports 1942/45

Rubber has already occupied the position of one of the most important items on the list of Brazilian exports. However, despite difficulties through which rubber production has passed during the last few decades, the economic value of the product has in no way decreased. Its possibilities are immense, not only from a commercial point of view, but also under the present circumstances as a strategic material, and as such, it is essential that production should be developed along adequate lines, by a rationalization of the methods of extraction, as much as by the application of scientific methods of planting, the success of which has been thoroughly demonstrated in the eastern countries, which have specialized in the culture of the rubber tree.

It is a matter of general knowledge that Brazil was the largest source of rubber in the past. About forty years ago, 65% of the latex used in the industries of that period originated in Brazil.. Production which approximated to 394 tons in 1839-1840, had risen to 39,000 tons in 1909, or three fifths of the world output. In 1910 exports amounted to 276,000 thousand cruzeiros of crude rubber, a figure only slightly below that of our principal export, coffee.

This gives an accurate idea of what the product meant as a contribution to the trade of Brazil in general and to the economic advantages of the population of the country in particular.

Various circumstances were responsible for Brazil's loss of the supremacy on the international rubber markets. The transplantation of rubber trees to the East, where they became the object of intensive and rationalized culture, placed the national product in a disadvantageous position from the point of view of production costs, selection, and the preparation and standardization of definite types, was, however, the principal cause of the depression. The situation was further aggravated by the fact that, for motives of a rather complex nature, and principally on account of the lack of financial resources, Brazil adhered to traditional and routine methods of production ignoring the technical revolution that set a new course for rubber economy.

Consequently owing to these factors the national product failed to rise above the low level in which it found itself at the close of its prosperous age and little variation took place, either in the volume of production or in the value obtained. As to the quality of the product and the improvement of types, no modification can be noted which exercised any appreciable influence on the production taken as a whole.

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* *Brazil Trade Journal*, April-June, 1946.

The production of latex in the American Continent is derived almost exclusively from the Amazon basin, where the number of trees is estimated at 300,000,000, with a potential productive capacity of 600,000 tons of rubber annually the greater part of which lies in the territorial limits of Brazil.

The largest volume of the world's natural rubber output is obtained from *Hevea brasiliensis*, a tree of considerable height although it has been acclimatized, with success, in other regions; its natural habitat is the north of Brazil or more exactly the jungle of the Amazon basin. In some States of the North-East and Central regions of Brazil, a certain amount of latex is extracted from a variety of other plants which grow wild and are tapped for rubber, though the quality is considerably inferior to that of the true Hevea.

Although Brazil's output is as yet insufficient to fill the requirements of world's industry, the prospects are now encouraging. In her position as principal producer of latex in the hemisphere, Brazil, by carrying into effect a well planned constructive program, may well recover the greatest part of its former markets.

The most important of these markets is the United States. The needs of our great industrial neighbour, in normal times, exceed 600,000 tons of latex, feeding an industry which employs more than 120,000 workers and claims of a production estimated at 900,000,000 dollars.

But the lure of foreign markets should not blind us to the future possibilities within our own boundaries. The vigorous expansion of Brazil's economic activities has promoted a corresponding development in home industries, such as the manufacture of all kinds of finished products with rubber as basic raw material. This branch is daily acquiring greater importance, specially in the field of tyre and inner tube manufacture. The rate of progress along these lines justifies the most encouraging expectation of industrial self sufficiency in a none too distant future, thus eliminating the import of these articles.

It is, however, the shifting of ocean traffic lanes which has fortified our position as rubber producers. In view of the war the United States saw her supply lines from the Far East cut off and this situation, combined with a rapidly increasing demand and an acute shortage of rubber, raised the Brazilian latex up to a position of high strategic value.

An agreement was signed in Washington between the Brazilian Government and the Rubber Reserve Corporation, representing the American Government for the development of rubber production.

As a result of this agreement it may be predicted that Brazil will be again among the leading producing countries, if not in quantity, surely in quality.

Brazilian Rubber Exports 1912/1945.

Years	Quantity in tons	Value in Cr$ 1,000	Years	Quantity in tons	Value in Cr$ 1,000
1912	42,286	241,425	1929	19,861	61,114
1913	36,232	155,631	1930	14,138	33,584
1914	33,531	113,598	1931	12,623	25,599
1915	35,165	135,786	1932	6,224	10,626
1916	31,495	152,239	1933	9,453	21,687
1917	33,998	144,080	1934	11,150	33,642
1918	22,662	73,728	1935	12,370	36,063
1919	33,252	105,537	1936	13,247	68,016
1920	23,586	58,350	1937	14,792	76,001
1921	17,439	35,903	1938	12,064	46,649
1922	19,855	48,760	1939	11,805	56,680
1923	17,995	81,177	1940	11,835	77,467
1924	21,568	79,212	1941	10,734	91,185
1925	28,537	191,803	1942	12,204	148,416
1926	23,263	114,877	1943	14,575	189,057
1927	26,162	115,008	1944	21,192	365,839
1928	18,826	58,999	1945	18,887	345,924

TEA RESEARCH IN RELATION TO ADVISORY WORK*

(A lecture delivered to the Morawak Korale Planters' Association)

There are two mutually exclusive heresies that continually crop up in the advisory work of the Institute. One is that a method perfected, or a discovery made, in one set of circumstances can be applied in others with equal success. The other is that every estate or district is a law unto itself and therefore generalisation is impossible or unprofitable. Both of these statements are too sweeping: the truth lies somewhere in between. It is the function of scientific research not only to make, if possible, new discoveries but to trace and define the underlying similarities that exist in apparently different circumstances. Having done this, sound advisory work concentrates on applying these generalisations with such modifications as local conditions demand. I understand that in this district you are much exercised in your minds as to what application the work we do at St. Coombs has to your conditions, and I shall use my time with you to-day in trying to clarify this issue.

The problem is simplified for us to some extent by the fact that we are growers of a single crop. We do not have to arrange our agricultural system to include crops of widely different types and requirements. Our main concern is to fit our one crop and its cultivation into a variety of environments. Each specific environment is governed by two main factors: (1) soil, (2) climate, which interact with one another and have a profound effect on a third, the biological factor. This factor is sometimes overlooked except in its harmful manifestations as plant disease. In this district the presence of Helopeltis is an example of a biological factor peculiar to your environment.

In Ceylon the soil factor is more uniform than in many countries, and at any rate the tea districts show no tremendous differences in character of the soil. There are differences, but these are more in degree than in type. The rocks from which the soils are derived are closely related: the weathering conditions under which they have been formed are not markedly dissimilar. This is very important because a uniform type of weathering will produce the same type of soil from quite different rocks. To come to practical properties, nearly all our soils are acid. They are porous and workable unless they have been grossly mismanaged. Although erosion is a serious problem our soils are only moderately erodible. They are, in fact, soils of good structure. Except when intensively cultivated they are low in nitrogen; they are deficient in phosphorus but have a relative abundance of potash. We have no sailt problem, and as far as we know there are no marked deficiencies in the rarer mineral elements, lack of which devastates

* By Dr. T. Eden. *The Planters' Chronicle*, Vol. XLI No. 16, August 15, 1946.

agriculture in many places. The one thoroughly objectionable soil type that is entirely detrimental to tea is that derived from limestone. There is a little of this in the northern reaches of your district, but in the tea districts as a whole it is of small importance. There are, as I said, some differences. Up-country we have no typical laterite or cabook, but agriculturally our red earth soils behave similarly though to a modified degree.

When we come to climate, the story is different. Small as the area under tea is, there are within it marked variations in rainfall, humidity and temperature, and of these temperature is probably the most important. As regards rainfall and humidity, the perennial deep-rooting habit of tea acts as a considerable safeguard against severe loss by drought, in comparison with what happens to annual crops in like conditions. As you are aware, the greater part of the solid tissues of a plant are derived from carbon dioxide in the air. The efficiency of the process of carbon assimilation is affected both by temperature and light intensity, but the predominating factor is light intensity. Temperature does, however, influence the balance between that portion of the carbon which is used for active growth and that which is held in reserve, to the detriment of the latter. To put the idea colloquially: at low elevations tea leads a more hand-to-mouth existence than in the cooler regions. I shall return to this matter later.

High temperatures speed up the chemical processes not only in the higher plants such as tea but in the host of micro-organisms associated with soils and plants. Decay, the result of micro-organic growth, is accelerated. In the soil, nutrients are more easily released and wasted and in the plant the tissues when invaded by harmful organisms decay at a greater rate. You will observe that what I am describing is not a radical change in the physiology of the tea bush but a quickening of the tempo at which it lives.

So far I have dealt in general terms with the differences in environment that are encountered in our tea districts. I propose now to deal with some of the questions that have been investigated by the Institute and to indicate what generalisations emerge from the results obtained and under what circumstances these need modification in different environments. Ever since the foundation of the Institute we have been studying the problems of manuring. From what I have said about our soils it is apparent that our experiments at St. Coombs will have a wide application. The results of these have been set out in our journal and annual reports and I will merely summarise the conclusions up to date. For doses of nitrogen up to and beyond those in practical use the proportionality of dose and yield is an established fact. During the rationing period for manures the applications of nitrogen have been limited. Some people thought that such small doses would be ineffective, but experience has not proved them correct.

Phosphates do not give a response proportional to their rate of application. Above 30 lb. per acre the increase is very small and economically negligible. This is in accordance with experience on similar soils all over the world. Recently an observation of a novel kind has been made

in respect of phosphatic manuring: that it has a remarkable effect on weed growth. Not only is a heavy weed population encouraged by phosphates, but even when no further growth is engendered the phosphate continues to increase in the weed tissues, and, under a system of clean weeding, is consequently lost for ever to the major crop. Potash applications are just beginning to show an effect when compared with plots starved of that element for 15 years. As regards weed growth the influence of potash is neligible in promoting growth; but, as with phosphate, it piles up in the tissues and is consequently a dead loss.

These general results which apply over a wide range of environments may in practice be vitiated by an unfavourable pathological factor. Evidence is accumulating from the Entomological Division that shot-hole borer, by causing large-scale branch breakage and loss of plucking points, can nullify the normal responses to manuring.

Turning from the question of manuring in general to time of application in particular, this is an aspect where climate has a marked effect and where uniformity cannot be expected. Manuring in a drought is not to be recommended, because not only are the feeding roots at a minimum of activity, but those remaining in action are likely to be damaged by dry weather cultivation. Temperature also has a bearing on time of application of manures in relationship to time of pruning. At high elevations applications of manure immediately after pruning have been found to be relatively ineffective. This has been traced to the fact that a clean-pruned bush is unable to use the nitrogen supplied as manure till it has grown a good canopy of leaf. In low-country districts where clean pruning is not practised, and where the leaf canopy is quickly re-established, the necessity for delay in application of manure does not exist.

The mention of different styles of pruning takes us back to what I said previously about tea in low-country districts leading a more hand-to-mouth existence than up-country tea as regards stored food reserves. One of the first discoveries made by the Institute was that of the real cause of deaths after pruning in the low-country. Previously these deaths had been attributed to the *Diplodia* fungus. In fact, they were due to the exhaustion of reserve food supplies in the root. By clean pruning, which at the time was extensively practised at all elevations, the bushes were deprived of the very tissues which manufacture carbohydrates on which new growth after pruning depends. The experiments on pruning methods which followed this discovery verified the observation that carbohydrates do not accumulate to any extent in root tissues at low elevations and suggested a method whereby these details could be prevented. By adopting cut-across pruning which leaves a considerable amount of foliage on the bush, or by leaving 'lung' branches to function during the critical period, deaths and dieback were successfully prevented. One or other of these methods is now standard practice at elevations below about 3,000 feet.

You have asked me to deal with the question of regeneration of tea, and this is the place to do it. I shall not allow myself to be manœuvred into an argument as to whether a tea bush suffers from senility, but shall stick to verifiable facts. When you say that a field needs rejuvenating you mean that its bushes are low yielders; the new wood is spindly or scarce; the old wood is scarred with pruning cuts, and furrowed with wood rot. I spoke earlier of the increased wastage due to higher temperatures favourable to micro-organisms. To set against your quicker bush growth you have the disadvantage of more rapid wood rot. The old practice was to cut away all the worthless wood by collar pruning and try to grow healthy wood from the collar. The devastating results of this method have been shown on countless fields, and, bearing in mind what I have just said about starch reserves, the result is a necessary consequence of the cause. The most rational way to rejuvenate a low-country field is to grow new plants and to grow them in such a way that the possibility of invasion of pruning cuts by wood-rotting fungi is minimised. I shall return to this in a moment. Here I wish to say that rejuvenation by supplying is a well nigh hopeless task if the majority of the supplies are singletons. The competition from the adjacent bushes dooms them to failure. Supplying in patches is the only reasonable alternative, but it calls for a shrewd decision as to when to sacrifice a bush which is on the downgrade but not a perfectly obvious candidate for removal.

A programme of supplying poses the question ' With what ? ' The usual alternatives are stumps and seed-at-stake or basket plants. If the Institute's work on propagation of selected material by cuttings fulfils its present promise, this method of rearing young plants will have to be taken into consideration by progressive planters. Stumps have the disadvantage that by the time they have a good supply of self-supporting foliage a large centring cut is necessary, and that paves the way for wood rot. Seedlings and cuttings grow with a more favourable habit. They can be cut across early in an operation that is little more than tipping into red wood. This besides leaving some foliage, ensures that the smaller cuts have a real chance of callusing. The lower branches will thicken and in time build up a clean frame which need never be touched in its lower regions. In this way there is the possibility of eliminating the far too common sight of a bush with severe wood rot at the centre.

The proposal to use rooted cuttings as material for supplying is a novel one to which my colleague Dr. Gadd is devoting attention. In our experience growth of cuttings is equal to, if not greater than that of seedlings of the same age when the propagating material used is good. In addition the resulting bushes are better and more uniform than those obtained from seedlings. I do not propose to deal with the technique of raising cuttings. You will find a detailed description of the method in an article in the *Tea Quarterly* by Mrs. Bond and myself. What needs to be insisted on is though I have mentioned certain advantages that are

possible with cuttings, the main factor in promoting success is to propagate a bush of good type. It is no use using cuttings from bushes chosen at random. The whole argument for 'rejuvenating' is to finish with something that is better than the original. That means selection and pre-eminently selection from your own fields. The habit of the bush, the cleanness of its wood and abundance of flushing points are prime considerations. Supplying by cuttings is not a method that can be put into large-scale operation now. It needs observation and experiment which only you can do. We have demonstrated its possibilities. Its practical application will be in your hands.

NEW WAYS OF PREPARING TAPIOCA AS A SUBSTITUTE FOR RICE

The people of Malaya became very tired of eating tapioca during the Japanese occupation, and now are very unwilling to grow it and eat it even though there is a serious shortage of rice and prices of rice are accordingly very high.

Considerable interest attaches therefore to a paper prepared by the office of the Special Commissioner in South East Asia which describes the methods of preparing tapioca in South America, where, over large areas, and known as manioc, it has always been a staple article of diet. The preparation of tapioca in South America which is chiefly used is called " farinha " or " farine." It is a digestible and satisfying preparation. But, in Malaya and apparently in other territories of South East Asia into which tapioca has been introduced, a flour called tapioca flour is the main preparation. This differs from farine in that it consists mainly of starch washed out of the roots. This starchy flour contains only about one third of the proteins of the roots, whereas farine contains most of the protein of the roots, and a little of the starch has been washed away. All roots are poor sources of protein and cannot be recommended as staple articles of diet unless they are well supplemented with fish or some other food rich in proteins, but farine is the best preparation of tapioca root; it is more palatable, satisfying and nutritious than the starch flour. It is probable that, if it is properly prepared, it will be acceptable during a shortage of rice to the majority of the population. It keeps well when stored. Farine and not tapioca flour, should be stored against an emergency.

The method of making farine is as follows:—

(i) The roots are peeled and washed, or they are soaked for up to 4 days in water and the peels rubbed off.

(ii) The peeled roots are grated by rubbing them on galvanized or ordinary sheet iron in which a number of holes have been punched so as to leave jagged, protruding edges.

(iii) The grated pulp is placed in basket work strainers and pressure applied to squeeze out the juice, which contains prussic acid. This juice is used as a by-product; it is boiled to the consistency of treacle, which removes the prussic acid, and used to prepare " pepperpot " and other sauces.

(iv) The grated pulp is dried on iron plates or shallow cauldrons over a fire, and is agitated so that it breaks up into a coarse flour, or it may be dried as cakes.

In the Amazon valley the type of farine resulting from first soaking the tapioca root in water for four or five days is called " farinha d'agua ", and is the type most favoured as being more palatable. On the other hand

the farine made after a very brief preliminary soaking or without any preliminary soaking is more easily digestible.

Farinha entirely replaces bread in most parts of the Amazon country and is often the only food consumed by entire families for weeks on end. Boatmen and other workmen engaged in extremely hard work for long periods are quite satisfied so long as their supply of farinha is assured, and the only supplies carried for long trips into the interior consist of farinha and a little dried salt beef or salt fish.

As an emergency food, farinha has many advantages; it is a concentrated foodstuff, sustaining, and at the same time quickly satisfying the feeling of hunger. Above all, it can be stored for long periods without being attacked by insects.

The coarse farine flour, without further cooking, makes a pleasing addition to soups, boiled vegetables, boiled or fried fish, curries and many other dishes.

Notes and Comments.

GOVERNMENT GUARANTEED PRICES FOR PADI AND FOODCROPS.

In order to cover the purchase of padi from next season's crop, the main harvesting of which will take place during the first quarter of 1948, the Government guaranteed prices of $20 and $19.20 per picul for padi delivered at the mill and purchased in the field respectively, will now be paid up to 30th June, 1948, instead of 31st December, 1947, as originally notified.

Government has also announced guaranteed prices of $15 per picul for the purchase of maize and ragi and $20 per picul for groundnuts. These prices will be effective up to the end of 1947.

COPRA AND COCONUT OIL.

An official communique issued early in March stated that the United Kingdom Ministry of Food had agreed to buy Malayan copra and coconut oil at £40 and £70 sterling per ton f.o.b. respectively.

NEW PLANTING AND REPLANTING OF RUBBER.

By Gazette Notification dated 13th March, 1947, the restrictions on, or prohibition of, new planting or replanting of rubber in the Malayan Union have been cancelled. Similar action has been taken in the Colony of Singapore.

TEA CULTIVATION IN MALAYA.

Recently compiled statistics show that 23 tea estates are now in production, all in the Malayan Union. The total planted area of tea in the Highlands is 4,744 acres, and of Lowland tea 2,573 acres, making a total of 7,317 acres as compared with 8,898 acres at the end of 1940. Total production of made tea is at present in the neighbourhood of 60,000 lbs. per month.

"The Planter"

The Planter makes a welcome reappearance with it's January number, the first issue since 1941. This magazine is to be published monthly as previously, and the annual subscription is $24. It is good to see that the well-remembered correspondent "Don" has successfully survived the war, and his pen is as caustic as ever. An article by Mr. C. C. T. Sharp, acting Head of the Botanical Division of the Rubber Research Institute of Malaya, gives details of the yields and other characteristics of the R.R.I. Clones. An address entitled "Naturalistic Methods in the Control of Malaria", given by Dr. J. N. Dugdale to the Johore Branch of the Incorporated Society of Planters, is reprinted.

The issue also includes particulars of the Cowgill Scholarship at Durham School donated by Mr. J. V. Cowgill, C.M.G., who was British Resident, Negri Sembilan, before the Malayan War. The Scholarship is primarily intended for the sons of parents of British or British Dominion nationality who have been resident in Malaya not less than 10 years.

To quote the editorial "The thing that matters most is that the Mother of this periodical, the Incorporated Society of Planters, is on its feet again—not unscathed, but more virile than ever and in confident earnest." We wish mother and child continued success in post-war Malaya.

Review.

THE ECONOMIC REVIEW OF INDONESIA

Issued by the Department of Economic Affairs, Batavia, Java.

Price 11 guilders per annum post free.

This is a new publication of the Netherlands Indies Department of Economic Affairs, and we have received a copy of the second issue, February 1947. It is published in English. An article entitled "The Industries of the Indies since the Japanese Capitulation" shows clearly the difficulties with which the Dutch have had to contend in restarting industry after a long period of enemy occupation in a country in the throes of political upset. Considerable progress has been made in Batavia where the greater proportion of industry, in territory controlled by the Dutch, is situated. Fortunately Batavia has suffered least from the destruction of buildings and factories. In January 1946 the number of workers in industry was only a few hundred, but by mid-1946 had increased to about 30,000. Measured in terms of equipment, industry in Batavia is estimated to be working at half its pre-war capacity. An interesting article dealing with Java's sugar supply shows how seriously that major industry has suffered from the inability to reorganize and rehabilitate it immediately after the Japanese surrender. Other articles deal with the revival of private enterprise, and explain the regulations governing the movement of goods within Indonesia and between Indonesia and other countries.

This magazine should have a wide circulation in Malaya, providing as it does an up to date picture of conditions in these neighbouring islands.

H. J. B.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports of Agricultural Officers.

January and February, 1947.

The Weather.

Wet weather eased off slowly during January but light showers were common. Towards the end of the month there was more sunshine and it became hot and dry in many districts. Unusually heavy rains were, however, experienced in Penang and Province Wellesley whereas in Malacca it was well below average. Conditions generally were hot and dry during the first three weeks of February with occasional light to heavy showers later. In Johore, in contrast to normal February weather conditions, this year the rainfall was heavy throughout the State with moderate temperature.

Crop Reports.

Foodcrops and Vegetables.—Good progress was made in Penang in the planting of vegetables and foodcrops on padi land during the off-season, and groundnut seed and lime were distributed free to those cultivators undertaking this form of cultivation for the first time or extending their areas. Maize and vegetable planting on the bunds in the padi fields in Province Wellesley covered an area of about 650 acres at the end of January.

With the termination of the padi harvest in Pahang, renewed interest was shown in the planting of short duration foodcrops, and Malays planted maize, groundnuts and green gram. There was a steady development of areas by Chinese cultivators at Jerantut, Benta, and along the Manchis road, sweet potatoes, soya bean, groundnuts, chillies and vegetables being planted.

The output of fresh vegetables at Cameron Highlands during January continued to be high but prices fell during the middle of February when large quantities were imported into Singapore from Australia and China. The output of vegetables for January is estimated at about 500 tons but there was a very considerable reduction during February.

Fallow season cultivation of vegetables and foodcrops in the padi fields of certain districts of Malacca showed great activity. Cultivators, for the most part Chinese with only a leavening of Malays, were busily engaged in stacking padi straw, digging up and burning stubble, ploughing and planting. Some 466 acres in Central District and 120 acres at Alor Gajah are already planted up with sweet potatoes, tomatoes, chillies, ginger, turmeric, cucumbers, and leaf vegetables. The methods of cultivation are sound, especially the use of padi straw for deep mulchings. Although the extent of fallow season cropping in the padi areas has increased during and since the war, nevertheless some of the Chinese have been farming the same area of padi land for over 30 years.

Wet Padi.—Harvesting was in full swing throughout Kedah during February but from reports received the average is much below expectation. The high price offered by Government for padi has however greatly assisted the cultivators, who are able to obtain a good price for their surplus padi.

In Perak, harvesting was undertaken during February in the earlier planted areas of Krian, and Larut and Matang. In the later planted areas the padi reached the flowering stage. In the mukim of Kuala Kurau, where planting was very uneven, about half the area was in the flowering stage, and about 650 acres were harvested, yields averaging about 320 gantangs per acre. Both stem-borers and rats have caused only very slight damage this season and it is estimated that, in Krian, not more than 100 acres have been damaged and the area of attack is so scattered that the effect on total yield is likely to be negligible. Harvest is late at Sungei Manik, but yields in the older areas are likely to be fairly good. Applications for land in Stage IV are arriving in well.

Harvesting was completed in almost all districts in Pahang. Crops were fairly good in Pahang North, averaging 175 to 200 gantangs per acre; in Pahang South the crop was good, averaging 200 gantangs per acre. In Pahang East about half the padi crop in Pekan and Kuantan Districts was harvested with yields averaging 150 and 100 gantangs per acre in the respective Districts. Chinese cultivators throughout the inland districts have sown nurseries in preparation for planting the off-season crop during March.

In the main coastal area of Selangor harvesting commenced in some of the southern areas during February whereas transplanting was only completed in the north. In inland districts, transplanting was completed on 286 acres at Dusun Tua and Kuala Lui; this is a second crop, the first having been harvested in October-November, 1946. Transplanting of the second crop at Ulu Gombak, in the Kuala Lumpur District, was nearly completed, growth of early fields being promising.

In the Jelebu District of Negri Sembilan, the six ploughing instructors from Malacca completed their work at the end of February, and a number of buffaloes were trained in each mukim. The response to the ploughing campaign has been satisfactory and is gaining momentum. The main difficulty is to purchase ploughs at reasonable prices; nine ploughs were purchased from Malacca at $42 each and these are being loaned out in rotation. An experimental all-metal plough was made locally and if satisfactory could be made in quantity at a price of not less than $20. Arrangements are also in hand with a local engineering firm for the manufacture of mould boards and shares, as the growers can make the wooded framework themselves if they can obtain the metal work at a reasonable price.

Harvesting was either completed or in progress in all districts in Malacca. A few cultivators in all districts are experimenting with two padi crops during the year. Radin Siak 34 and Padi Wangi are the two padi varieties planted.

Rubber.—Wintering was seen in all districts of Province Wellesley but the leaf fall was not so complete as in previous years.

Prices in Kelantan remained steady during January, at $45 per picul for smoked sheet, $38 per picul for unsmoked and $16 per picul for lump and scrap. The interest shown by small-holders in the erection of co-operative smokehouses is unflagging.

In Selangor, wintering was general throughout the State during February with the result that yields were lower than previously and few new areas came into tapping. The co-operative smokehouse at Batang Kali is working satisfactorily and saves members $1 per picul. Capital has already been raised for a similar venture at Kalumpang. A grading scheme has been accepted by dealers in Ulu Selangor who are now paying a premium for good quality sheet.

Coconuts.

The rise in the prices of coconut oil resulted in a heavy demand for copra in Kedah, which increased $3 per picul during February. Relative prices in Kuala Muda, the most important coconut growing district, were $15 per picul of copra during January and $18 per picul in February.

In Perak, seven oil mills were operating during February in and around Ipoh. Oil production is in the region of 5,000 piculs a month with a like amount of copra cake. Prices were 25 to 28 cents per kati for oil and 15 cents per kati for copra cake ex factory.

Poultry.

In Malacca, the output from local hatcheries remained about the same as for the two previous months. The actual out-turn during February was 28,620 ducks and chicks, which sold at 35 to 40 cents each. Goslings said to be imported from Siam rose in price to $4.50 to $5 each. Egg prices remained steady at 15 cents for hen and 12 cents for duck eggs. More attention was paid to poultry keeping, and an unsatisfied demand for laying pullets existed in many kampongs. Duck farming increased in popularity and reports from several such farms, both Malay and Chinese, indicated that a reasonable livelihood might be made from this form of industry.

Miscellaneous.

Demonstrations and Instruction.—Parties of small-holders were conveyed to the Agricultural Station at Bukit Mertajam, and the Padi Test Station at Bukit Merah, Province Wellesley, during January to see the work in progress. In Penang, a party of Malays from Balik Pulau, competitors in the recent Home Garden Competition, were taken to Bayan Lepas to see the winning garden.

In the Ulu Langat District of Selangor seedling rambutan nurseries were planted at ten school gardens in order that budding may be demonstrated later to the pupils.

Early in February, demonstrations were given at Pulau Gadong Padi Experiment Station, Malacca, to Penghulus and selected cultivators, some 144 persons attending. In addition, lectures were given on padi seed selection, fallow season cultivation, and rat destruction methods.

DEPARTMENTAL NOTES

Appointments

Mr. H. L. Barnett, Acting Agricultural Economist, has been appointed to act as Registrar of Statistics, Malayan Union, in addition to his other duties, with effect from 25th July, 1946.

Mr. H. T. Pagden, Senior Entomologist, has been appointed to act as Director of Museums, Malayan Union, in addition to his other duties, with effect from 1st January, 1947.

Mr. J. J. Holmes has been appointed to the post of Assistant to Agricultural Economist with effect from 27th January, 1947.

Mr. G. S. Keeping, B.Sc., Dip. Agr. Sci. (Camb.), has been appointed an Agricultural Officer in the Colonial Agricultural Service. Mr. Keeping has been posted to the Malayan Agricultural Service and arrived in Malaya on 5th February, 1947. He is stationed at Headquarters, Kuala Lumpur.

Transfers.

Mr. E. J. H. Berwick, Agricultural Officer, Perak South, has been transferred to Headquarters, Kuala Lumpur, with effect from 10th March 1947, as Agricultural Liaison Officer, (Food Production).

Leave.

Mr. A. Thompson, Senior Plant Pathologist, returned from leave on 5th February, 1947.

Mr. Gunn Lay Teik, Chemist, returned from leave on 5th February, 1947.

Mr. E. F. Allen, Agricultural Officer, returned from leave on 6th March, 1947. He assumed duty as Agricultural Officer, Perak South, with effect from 10th March, 1947, and will also act temporarily as Agricultural Officer, Cameron Highlands.

Mr. O. M. Lee, Vice-Principal, School of Agriculture, Malaya, has been granted 120 days vacation leave in addition to voyages with effect from 15th February, 1947.

Dr. W. N. Scott, Agricultural Officer, Johore North, has been granted 240 days vacation leave in addition to voyages with effect from 9th March, 1947. Mr. P. V. Ormiston, Agricultural Officer, Johore Central, will take charge of Johore North in addition to his other duties.

Visit to Ceylon.

Mr. H. J. Simpson, Agriculturist, Central Experimental Station, Serdang, visited Ceylon in January, returning in February. The main purpose of the journey was to visit the Tea Research Institute there in order to obtain the latest information in connexion with the cultivation of tea with the object of bringing current practice in Malaya up to date.

Mr. Simpson also took the opportunity of visiting the Department of Agriculture, Ceylon, where matters of mutual interest to both Departments were discussed, with special reference to the mechanized cultivation of dry land crops and wet padi.

Statistical.

MARKET PRICES.

March 1947.

Rubber.—The Singapore price of rubber remained steady at about 42⅛ cents per lb. during January, February and the first half of March. In the second half of March the price advanced from 42⅛ to 44¼ cents per lb. easing to close at 44 cents per lb.

Average prices for London and New York are not available.

The average prices paid for small-holders' rubber at three centres during the first quarter of 1947 are given in Table I.

Table I.

Average Weekly Prices Paid by Local Dealers for Small-Holders' Rubber, January-March, 1947.

(Dollars per picul of 133⅓ lbs.)

Grades	Ipoh, Perak.			Kuala Pilah, Negri Sembilan.			Batu Pahat, Johore.		
	Jan.	Feb.	Mar.	Jan.	Feb.	Mar.	Jan.	Feb.	Mar.
Smoked Sheet ..	50.77	50.55	51.40	49.10	49.50	50.16	48.75	48.55	49.14
Unsmoked Sheet ..	42.70	42.00	42.45	43.25	43.83	44.55	43.30	42.17	42.32
Scrap ..	18.50	17.50	18.12	17.17	18.00	18.66	18.50	19.20	20.66

Transport from Batu Pahat to Singapore by lorry, excluding duty, $1.00 per picul.

Table II.

Singapore Prices of Various Agricultural Products.

Product	March, 1947			February, 1947	Average Price Jan.-Oct. 1941
	Highest	Lowest	Average	Average	
	per picul $	per picul $	per picul $	per picul $	per picul $
Copra:					
Sundried No. 1 ..	21.00	17.50	19.00	17.20	
No. 2 ..	*	*	*	*	2.58
No. 3 ..	*	*	*	*	2.33
Coconut Oil ..	37.00	30.00	34.00	37.20	8.64
Coffee:					
Padang Bali No. 1 ..	142.00	125.00	139.00	115.50	*
No. 2 ..	130.00	100.00	124.00	109.00	*
Palembang No. 1 ..	66.00	62.00	64.00	61.80	18.07-19.91
Sourabaya New No. 1	88.00	84.00	86.00	83.00	19.13-21.02
Bali Old ..	*	*	*	120.00	*
Pepper:					
Muntok White ..	142.00	130.00	137.00	141.00	15.33
Lombong White ..	137.00	120.00	127.00	127.50	*
Sibu White ..	135.00	132.00	134.00	137.60	*
New Black ..	104.00	104.00	104.00	102.30	*
Old ..	*	*	*	*	*
Sarawak ..	134.00	123.00	128.00	*	*
Siam Black ..	116.00	98.00	104.00	*	*
Nutmeg:					
No. 1 ..	*	*	*	110.00	25.19
No. 2 ..	*	*	*	93.00	23.66
Cloves:					
Indian ..	46.00	43.00	44.00	41.00	*
Sumatra ..	56.00	55.00	55.00	54.00	*
Gambier:					
Cube No. 1 ..	100.00	80.00	89.00	90.00	13.65
No. 2 ..	*	*	*	*	*
Cake ..	*	*	*	110.00	*
Sago Flour:					
Lingga ..	16.50	16.25	16.46	17.00	*
Local No. 1 ..	16.00	15.75	15.88	19.50	*
No. 2 ..	*	*	*	16.75	*
Tapioca Flour:					
Malayan No. 1 ..	35.00	29.00	33.50	28.00	*
No. 2 ..	26.00	26.00	26.00	20.00	*
Java ..	38.00	33.00	35.00	36.00	*

* Not quoted.

MALAYAN UNION PRODUCTION OF PALM OIL AND KERNELS.

(In long tons as declared by Estates)

Month 1947	Palm Oil	Palm Kernels
January	2,238.2	292.3
February	2,316.9	337.1
Total ..	4,555.1	629.4
Total May-December, 1946 ..	11,756.4	931.6 (Aug.-Dec.)
Total Jan.-Sept., 1941 ..	38,588.4	2,332.5
Total for the year 1940 ..	57,972.1	9,611.2

Stocks on estates as at 28th February, 1947, were: palm oil 2,047 tons, palm kernels 483 tons.

In February 32 estates (planted acreage 70,004 acres) were in production out of a total of 46 oil palm estates (planted acreage 77,457.9 acres).

MALAYAN AGRICULTURAL EXPORTS, DECEMBER, 1946.

Product	Net Exports in Tons.		
	Year 1940	Jan.-Oct. 1941	October, November and December, 1946
Arecanuts	43,915	24,633	5,424
Coconuts fresh†‡ ..	131,469†	178,404†	3,876†
Coconut oil‡	69,446	65,045	3,997
Copra‡	9,004*	32,682*	13,631*
Copra cake	1,215*	5,659*	1,032*
Gambier, all kinds ..	821	489	90*
Palm kernels	9,219	1,984	—
Palm Oil	56,091	44,406	6,640
Pineapples, canned ..	40,243	15,086	16
Rubber¶	547,202¶§	500,982¶§	153,940¶
Sago,—flour	2,525	1,752*	4,014
„ —pearl	4,848	6,217	20
„ —raw	4,816*	4,400*	1,171*
Tapioca,—flake ..	762	601	8*
„ —flour ..	2,649*	4,310*	6
„ —pearl ..	17,004	15,164	500
Derris	1,258	998	4,556
‡Copra equivalent ..	108,468	138,737	20,204

† hundreds in number. * net imports. ¶ production.

§ Malayan Union and Singapore.

MALAYAN UNION RUBBER STATISTICS.

Estates of 100 Acres and over. Production February, 1947.

In Dry Tons.

STATE	PRODUCTION						STOCKS		PREPARED LATEX PRODUCTION	
	European	Chinese	Indian	Others	Total	Total Jan./Feb. 1947	Beginning of Month	End of Month		
(1)	(2)	(3)	(4)	(5)	(6)	(7)				
Perak ..	4,015	454	237	22	4,728	9,416	3,549	3,813	Preserved field	
Selangor ..	4,349	362	91	5	4,807	9,592	4,219	4,360	Latex Centrifuge	381
N. Sembilan ..	3,250	268	129	113	3,760	7,444	2,462	2,430	Concentrate	849
Pahang ..	1,077	754	123	—	1,954	3,221	836	1,320	Revertex	100
Malacca ..	1,087	342	71	—	1,500	3,195	1,152	1,026		
Penang & P. Wellesley	268	75	3	—	346	772	338	338		
Johore ..	3,951	1,119	189	427	5,686	10,822	3,532	3,999		
Kedah ..	2,818	424	128	24	3,394	7,208	2,954	2,885		
Perlis ..	—	3	20	—	23	47	28	26		
Kelantan ..	275	34	—	22	331	573	259	350		
Trengganu ..	57	44	—	3	104	165	77	108		
Total ..	21,147	3,879	991	616	26,633	52,455	19,406	20,655		1,330

Notes:—1. Figures for production of prepared latex for export are included in the month's production figures, columns 2 to 6.

2. Production by estates of less than 100 acres for February, 1947, was estimated to be 23,370 tons. Total estimated smallholding production January and February, 1947, 50,118 tons.

3. Total latex production 1946, 5,223 tons. Latex production January, 1947, field latex 155 tons, centrifuge 652 tons, revertex 75 tons.

4. Stocks on estates of less than 100 acres are not ascertained.

5. The above forms part of the February rubber statistics published by the Acting Registrar of Statistics, Malayan Union, at Kuala Lumpur, on 21st March, 1947.

MALAYAN UNION RUBBER STATISTICS.

Acreages of Tappable Rubber Actually Tapped and not Tapped on Estates of 100 Acres and over for the Month ending 28th February, 1947.

STATE	Estimated Acreages of Tappable Rubber (9) + (11)	Acreage of tappable Rubber not tapped				Area of tappable rubber never been tapped (b)		Total Area not tapped (3) + (5) (c)		Total Area tapped during the month (c)		Area of tappable rubber rested under rotational systems (c)	
		On estates which have entirely ceased tapping		On estates which have partly ceased tapping (a)									
		Acreage	% of (3) to (2)	Acreage	% of (5) to (2)	Acreage	% of (7) to (2)	Acreage	% of (9) to (2)	Acreage	% of (11) to (2)	Acreage	% of (13) to (2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Perak ..	270,850	2,984	1.1	54,099	20.0	17,149	6.3	57,083	21.1	213,767	78.9	23,737	8.8
Selangor ..	317,543	1,093	.3	64,049	20.2	21,129	6.6	65,142	20.5	252,401	79.5	14,753	4.6
N. Sembilan ..	256,067	3,917	1.5	79,505	31.1	19,990	7.8	83,422	32.6	172,645	67.4	19,180	7.4
Pahang ..	91,135	943	1.0	21,895	24.1	10,230	11.2	22,838	25.1	68,297	74.9	3,494	3.8
Penang & P. Wellesley ..	28,839	586	2.1	4,222	14.6	1,987	6.9	4,808	16.7	24,031	83.3	5,245	18.2
Malacca ..	118,446	3,370	2.8	19,440	16.4	5,461	4.6	22,810	19.2	95,636	80.8	9,591	8.1
Johore (d) ..	421,953	6,896	1.6	125,307	29.7	51,829	12.2	132,203	31.3	289,750	68.7	23,638	5.6
Kedah ..	195,372	894	.4	40,577	20.8	17,488	8.9	41,471	21.2	153,901	78.8	26,615	13.6
Kelantan ..	29,846	215	.7	10,274	34.4	3,063	10.2	10,489	35.1	19,357	64.9	3,142	10.5
Trengganu ..	14,985	448	3.0	7,705	51.4	1,263	8.4	8,153	54.4	6,832	45.6	90	.6
Perlis ..	1,828	—	—	599	32.8	228	12.4	599	32.8	1,229	67.2	127	6.9
Total ..	1,746,864	21,346	1.2	427,672	24.5	149,817	8.6	449,018	25.7	1,297,846	74.3	129,612	7.4

Notes:—(a) Area out-of-tapping on estates which have partly ceased tapping refers to areas definitely being rested and excludes area on any tapping round.

(b) The acreage shown in column (7) is included in columns (3) and (5).

(c) Areas of tappable rubber rested under rotational systems are not considered as out-of-tapping and therefore columns (11) and (12) include columns (13) and (14) respectively.

(d) Registered estates only.

(e) This table was published by the Acting Registrar of Statistics, Malayan Union, on 26th March, 1947.

MALAYAN UNION RUBBER STATISTICS.

Summary of Stocks, Production, Imports and Exports of Rubber, February, 1947.

In Long Tons, Dry Weight.

		Tons	Tons
STOCKS (31st January)			
Estates	..	19,406	
Dealers	..	68,568	
Ports, awaiting shipment	..	18,709	106,683
IMPORTS	..		7,031
PRODUCTION			
Estates	..	26,633	
Small-holdings (estimated)	..	23,370	50,003
Total	..		163,717

		Tons	Tons
EXPORTS			
Foreign	..	41,087	
Local (to Singapore)	..	18,629	59,716
LOCAL CONSUMPTION	..		102
STOCKS (28th February)			
Estates	..	20,655	
Dealers	..	72,314	
Porst, awaiting shipment	..	10,930	103,899
Total	..		163,717

Note:—The above forms part of the February rubber statistics published by the Acting Registrar of Statistics, Malayan Union, at Kuala Lumpur, on 21st March, 1947.

MALAYAN UNION PADI STATISTICS.

PADI SEASON 1946—1947.

Acreages of Wet Padi harvested monthly and Estimated Yields.

STATE	Total Planted area Acres	Total to 31st January, 1947			February, 1947			Total to 28th February, 1947		
		Area Harvested Acres	Per cent (3) to (2)	Estimated Average Yield per acre	Area Harvested Acres	Per cent (6) to (2)	Estimated Average Yield per acre	Area Harvested Acres	Per cent (9) to (2)	Estimated Average Yield per acre
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Perlis ..	36,640	3,834	10.4	338	13,916	38.0	338	17,750	48.4	338
Kedah ..	236,820	63,413	26.8	212	96,572	40.8	257	159,985	67.6	239
Kelantan ..	132,814	9,220	6.9	121	20,805	15.7	200	30,025	22.6	176
Trengganu ..	34,771	6,728	19.3	161	192	.6	138	6,920	19.9	160
Penang & P. Wellesley ..	36,881	1,637	4.4	231	5,620	15.3	247	7,257	19.8	243
Perak ..	106,491	3,187	3.0	157	17,859	16.8	164	21,046	19.8	163
Selangor ..	34,113	2,728	8.0	237	3,593	10.5	236	6,321	18.5	236
Pahang ..	39,667	32,601	82.1	188	4,174	10.5	169	36,775	92.7	186
Negri Sembilan ..	29,612	26,015	87.3	201	3,491	11.8	161	29,506	99.6	196
Malacca ..	30,611	17,877	58.4	229	9,013	29.4	168	26,890	87.8	209
Johore ..	12,358	6,282	50.3	157	3,392	27.4	90	9,674	78.3	134
Total ..	730,778	173,522	23.7	201	178,627	24.4	235	352,149	48.1	218

Notes:—1. Compiled by the Acting Registrar of Statistics, Malayan Union, from returns received through the Field Branch of the Department of Agriculture.

2. Acreages are amended according to the latest returns received. The latest return is, therefore, the most reliable.

3. There is still a small acreage to be planted in Selangor and Johore.

MALAYAN UNION

PADI SEASON 1946—1947.

Acreages of Dry Padi harvested monthly and Estimated Yields.

STATE	Total Planted area Acres	Total to 31st January, 1947			February, 1947			Total to 28th February, 1947		
		Area Harvested Acres	Per cent (3) to (2)	Estimated Average Yield per acre	Area Harvested Acres	Per cent (6) to (2)	Estimated Average Yield per acre	Area Harvested Acres	Per cent (9) to (2)	Estimated Average Yield per acre
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Perlis ..	60	32	53.3	225	16	26.7	225	48	80.0	225
Kedah ..	4,390	2,958	67.4	60	582	13.3	75	3,540	80.6	62
Kelantan ..	29,863	9,755	32.7	93	18,752	62.8	104	28,507	95.5	100
Trengganu ..	18,182	14,750	81.1	142	2,476	13.6	117	17,226	94.7	138
Penang & P. Wellesley	840	54	6.4	136	30	3.6	138	84	10.0	137
Perak ..	14,120	9,154	64.8	87	4,966	35.2	88	14,120	100.0	88
Selangor ..	4,993	823	16.5	90	3,980	79.7	86	4,803	96.2	87
Pahang ..	3,980	3,247	81.6	92	733	18.4	71	3,980	100.0	88
N. Sembilan ..	40	31	77.5	31	5	12.5	15	36	90.0	29
Malacca ..	130	35	26.9	193	45	34.6	210	80	61.5	201
Johore ..	3,052	1,350	44.2	90	731	24.0	37	2,081	68.2	71
Total ..	79,650	42,189	53.0	107	32,316	40.6	98	74,505	93.5	103

Notes:—1. Compiled by the Acting Registrar of Statistics, Malayan Union, from returns received through the Field Branch of the Department of Agriculture.

2. Acreages are amended according to the latest returns received. The latest return is, therefore, the most reliable.

METEOROLOGICAL SUMMARY, MALAYA, DECEMBER, 1946.

Locality.	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes									Number of days							
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total		Most in a day. Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force, 8 or more	Total	Daily Mean	Per cent.
										ins.	m.m.	ins.								
Ipoh, Perak ..	90.8	72.4	81.6	97	70	83	74			8.41	213.6	1.44	18	17	8					
Port Swettenham, Selangor	88.3	72.3	80.3	93	68	77	75	84.3	84.8	4.86	123.4	1.57	14	10	1	2				
Sitiawan, Perak ..	87.6	73.2	80.4	91	71	81	75			12.31	312.7	2.25	20	17	3					
Kuala Lipis, Pahang ..	85.0	72.2	78.6	92	70	74	74	82.3		7.86	199.6	1.41	23	20	2	29				
Kuantan, Pahang ..	84.1	73.1	78.6	90	71	77	75			28.61	726.7	4.92	26	24	4	1				
Bayan Lepas, Penang ..	87.1	73.8	80.5	90	71	81	75			7.54	191.5	2.13	21	14	4					
Malacca ..	85.2	73.8	79.5	90	71	79	76			9.29	236.0	3.05	20	17						
Mersing, Johore ..	83.0	73.0	78.0	87	70	74	76			27.33	694.2	3.05	27	24	1					
Alor Star, Kedah ..	87.5	72.5	80.0	92	70	77	74			5.33	135.4	2.27	15	12	3	6				
K. Trengganu, Trengganu	82.9	73.3	78.1	88	72	75	77			47.54	1207.5	11.39	27	25		1	1			
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. ..	69.5	61.6	65.5	78	58	63	64	68.8		14.75	374.7	2.25	27	25		21				
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	71.0	57.6	64.3	76	53	65	62	68.7		7.11	180.6	1.12	26	22		2				

Compiled from Returns supplied by the Meteorological Branch, Malaya.

METEOROLOGICAL SUMMARY, MALAYA, JANUARY, 1947.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes.									Number of days							
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total.		Most in a day. Amt.	Precipitation .01 in or more	Precipitation, .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
										ins.	m.m.	ins.								
Ipoh, Perak ...	93.2	72.0	82.6	98	69	88	75			6.14	156.0	1.22	15	14	5					
Port Swettenham, Selangor	90.3	71.4	80.9	94	68	84	75	84.2	84.6	3.49	88.6	0.70	17	13	4					
Sitiawan, Perak ...	88.5	72.7	80.6	91	69	86	76			6.95	176.5	1.05	23	17	4					
Kuala Lipis, Pahang ...	87.4	72.0	79.7	91	69	79	74	82.5		7.60	193.0	2.03	20	17	1					
Kuantan, Pahang ...	85.8	73.2	79.5	88	71	79	75			19.61	498.1	7.16	21	20						
Bayan Lepas, Penang ..	88.1	74.1	81.1	91	72	85	76			8.10	205.7	1.87	15	13	6					
Malacca ..	87.5	74.2	80.9	90	71	79	76			5.39	136.9	1.11	14	11	3					
Mersing, Johore ...	83.3	74.5	78.9	87	70	75	80			15.41	391.4	3.46	17	16						
Alor Star, Kedah ...	89.6	72.3	80.9	92	70	86	74			3.44	87.4	1.81	12	9	3					
Kuala Trengganu, Trengganu	85.5	73.8	79.7	87	71	82	77			8.31	211.1	1.43	19	16						
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	69.2	61.3	65.3	74	59	65	63	68.5		7.43	188.7	1.10	22	18						
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	72.7	57.4	65.1	77	50	69	63	69.1		4.09	103.9	0.74	17	14						

Compiled from Returns supplied by the Meteorological Branch, Malaya.

METEOROLOGICAL SUMMARY, MALAYA, FEBRUARY, 1947.

Locality.	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes									Number of days							
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total		Most in a day. Amt.	Precipitation .01 in or more	Precipitation .10 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
										ins.	m.m.	ins.								
Ipoh, Perak ..	93.5	71.9	82.7	99	67	79	76			4.58	116.3	1.21	11	11	6	1				
Port Swettenham, Selangor	89.5	72.4	80.9	95	69	84	75	84.9	85.0	10.02	254.5	2.77	18	13	2	1				
Sitiawan, Perak ..	89.0	72.8	80.9	92	71	84	75			6.52	165.6	1.96	18	13	3					
Kuala Lipis, Pahang ..	87.0	71.5	79.3	91	69	75	74	82.9		4.83	122.7	1.16	13	12	7					
Kuantan, Pahang ..	85.3	72.1	78.7	90	69	79	74			19.46	494.3	5.45	17	16						
Bayan Lepas, Penang .	88.5	74.3	81.4	91	72	83	77			2.08	52.8	0.93	7	6						
Malacca ..	87.0	73.6	80 3	92	70	77	75			4.22	107.2	0.87	14	11	2					
Mersing, Johore ..	83.1	73.5	78.3	87	69	74	79			21.93	557.0	4.24	14	14		2				
Alor Star, Kedah ..	91.1	72.0	81.5	95	68	87	75			3.83	97.3	1.90	8	8						
K. Trengganu, Trengganu	84.8	72.1	78.5	89	69	77	76			25.21	640.3	4.91	19	15	2	1	1			
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. ..	70.3	61.1	65.7	75	58	64	63	69.7		6.09	154 7	1.07	18	17		14				
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	72.5	56.4	64.5	77	47	64	62	68.8		3.78	96.0	1.05	13	10		1				

Compiled from Returns supplied by the Meteorological Branch, Malaya.

METEOROLOGICAL SUMMARY, MALAYA, MARCH, 1947.

Locality.	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day.	Number of days					Total	Daily Mean	Per cent.
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F			Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
										ins.	m.m.	ins.								
Ipoh, Perak ..	92.5	73.3	82.9	96	69	75				13.17	334.5	2.94	15	15	8	1				
Port Swettenham, Selangor	89.9	73.7	81.8	92	72	85	76	84.9	85.0	13.93	353.8	3.44	20	20	3					
Sitiawan, Perak ..	88.3	74.1	81.2	91	71	82	76			8.81	223.8	1.78	19	17	5	2				
Kuala Lipis, Pahang ..	88.1	72.6	80.3	93	71	77	75	83.7		8.52	216.4	1.16	22	20	4	28	2			
Kuantan, Pahang ..	86.3	73.3	79.8	90	70	77	75			16.86	428.2	3.81	20	18	2	3				
Bayan Lepas, Penang ..	88.1	75.0	81.5	90	72	85	77			7.18	182.4	3.10	18	13	4					
Malacca ..	87.1	74.7	80.9	91	71	81	77			16.20	411.5	5.81	16	13	2					
Mersing, Johore ..	84.7	73.9	79.3	88	71	81	80			8.16	207.3	2.32	17	14	2					
Alor Star, Kedah ..	91.1	73.5	82.3	95	71	87	75			5.43	137.9	2.18	14	12	3	1				
K. Trengganu, Trengganu	86.0	73.5	79.7	89	72	78	76			17.52	445.0	3.18	20	19	1	5				
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. ..	71.5	62.6	67.1	78	61	63	65	70.3		11.44	290.6	1.55	21	18	1	16				
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	73.0	58.8	65.9	76	52	66	63	70.2		10.87	276.1	2.02	18	12	1					

THE
Malayan Agricultural Journal
JULY, 1947

EDITORIAL.

Off Season Crops on Padi Land

The utilisation of padi areas for the growing of crops, other than rice, in the off season was not practised to any large extent in the years preceeding the war. At present, however, with the need to produce food becoming more urgent, as it is realised that imports of rice are likely to fall below expectations, increased food production on all available and potential areas is of considerable importance.

Generally speaking the rice crop occupies the land for about six months of the year, and for various reasons it is not practicable to attempt to grow two crops of rice per annum, on a large scale, on the same land. During the period of occupation, the Japanese attempted to establish in Malaya the practice of growing varieties of short maturation padi in the inter-crop period. The results were far from satisfactory and it is doubtful if yields of padi could be maintained locally by this system so as to ensure that two light crops per annum would even equal one main crop, furthermore difficulties connected with irrigation in the off season would also reduce the chances of success.

In the article by Mr. Hartley included in this number of the Journal, it is shown that, on the type of soil on Bukit Merah Padi Station, satisfactory crops of groundnuts can be obtained in the off season by application of lime; and of other crops e.g. sweet potato, ladies finger, brinjal and cow-pea by the use of cattle or buffalo manure. It appears that increased yields of padi are obtained on this soil following cultivation in the off season and that it is the cultivation and not the manuring which produces the subsequent increased padi yield, although it is possible that liming for groundnuts may also lead to an increase. The need for adequate control of drainage in padi areas during the off season is stressed, since without it the possibility of loss of the entire off-season crops cannot be ignored.

Ubi Kemili.

A food crop which is popular in Province Wellesley is a low growing herb called, locally, "ubi kemili;" the plants produce edible tubers in clusters at the base of the stem. This crop does not appear to require manure on normally fertile soils, but good drainage is essential. Yields are high and a good price is obtained for the tubers.

We publish in the present number of the Journal an article by Mohd. Sa'aid bin Sheik Daud, Agricultural Assistant, which gives information on the methods adopted in Province Wellesley for propagation,

cultivation, harvesting and uses of this food crop. Suggestions for further investigation of these methods with the object of extending and improving the cultivation of ubi kemili are also mentioned.

Manila Hemp. Abaca fibre or Manila hemp is obtained from the pseudo-stem of the plant, *Musa textilis*, which belongs to the same genus as the banana. The fibre from Manila hemp is the most valuable of all fibres for the making of ropes used as marine cordage due to its strength, resistance to the action of sea water and suitability for use in block and pulley tackle.

The present world shortage of all hard fibres has resulted in a considerable rise in the market price of Manila hemp and has focussed attention on the possibility of extending the cultivation of this plant in Malaya, where, up to now, the crop has only been grown under experimental conditions by the Department of Agriculture and by a few European-managed estates. Further experiments, in the cultivation of this crop have begun.

Manila hemp requires a good, rich, well drained soil with a continuous supply of soil moisture and should find suitable conditions on alluvial soils in river valleys or certain coastal areas.

Samples of fibre prepared from three varieties of *M. textilis*, formerly imported from the Philippines and grown at the Central Experiment Station, Serdang, were submitted to the Imperial Institute, London, in December, 1946, for examination and report. The report, part of which is included in the article on Manila hemp published in this issue of the Journal, is encouraging, and indicates that the Malayan produced fibre could compete favourably with fibre produced in other parts of the world.

Emphasis is laid, however, on the fact that the market price is, at present, very much inflated and it would be unwise to count on obtaining similar prices in future years.

Animal Husbandry in Malaya In the present issue of this Journal there is published the first instalment of a series of articles dealing with the subject of animal husbandry, an important industry, which it is hoped, will begin to extend in this country within the next few years on a wider basis than in the past.

In the decade before the Japanese invasion of Malaya the Department of Agriculture had established a small stock farm at the Central Experiment Station, Serdang, where it was demonstrated that milk of the highest grade, equal in cleanliness and quality to that marketed in any part of the world, could be produced by Tamil labour under strict supervision. The Department also carried out investigations on other branches of animal husbandry, on hill stations and on the plains, especially on the production and maintenance of fodder grasses, feeding of cattle, pigs and poultry and breeding of animals and birds with the object of developing types suitable to this country, and improving the general standard of stock and poultry in Malaya. As a result of the pre-war activities in this direction a not inconsiderable local distribution of stud stock of pigs and pure and cross

breeds of poultry, had occurred. It is intended to recommence this distribution on extended lines as soon as circumstances permit, but it will take some years to re-establish the valuable stock which was lost during the Japanese occupation. Work has already commenced on goats by the importation from England, for stud purposes, of animals with high milk producing characteristics. The goat has been called " the poor man's cow " and these animals can play an important role in providing meat and milk for large sections of the population.

In 1940, Malaya imported nearly twenty three million dollars worth of livestock and livestock products which include meat, milk, eggs, ghee, cheese, butter, hides and skins. A greater local production of some of these products is desirable and possible, and there is need for encouragement and assistance to livestock keepers by the supply of better class animals, and providing facilities for improvement of cattle, buffaloes, pigs and goats by the emplacement at stud of selected sires in all centres where the services of such animals would be of value. Importations of pedigree pigs have recently been made and negotiations for additional importations are in progress. The upgrading of poultry has also received attention, and the first of several importations of new poultry stock have arrived and are being used at Cameron Highlands Agricultural Station as breeding stock.

While immediate large scale extension of animal husbandry in Malaya is limited by the funds at present available to the Department of Agriculture, and by other factors, it is thought desirable to disseminate information on the subject, and the article included in the present issue of the Journal serves as an introduction to a series of articles, written by two members of the Staff aided by the Veterinary Department. These articles cover cattle, buffaloes, pigs, and goats and were originally prepared for use as a text book in the School of Agriculture, Serdang. The senior author has made a life study of the subject and contemplates grouping the information, augmented with chapters on allied subjects, in the form of a book suitable for use in a course of instruction in this branch of agriculture, but, owing to printing and publishing difficulties, this is not at present feasible and, in order to avoid delay in publication, the information will be made available in this Journal, from time to time.

Original Articles.

EXPERIMENTS ON THE GROWING OF OFF-SEASON CROPS ON PADI LAND IN PROVINCE WELLESLEY

BY

C. W. S. HARTLEY,

Agricultural Officer, Penang & P. Wellesley.

In a previous article on this subject (1) an account was given of some preliminary trials at Bukit Merah Padi Test Station with vegetables grown during the off-seasons of 1933 and 1934. In these trials very poor yields were obtained, which was probably due to inadequate manuring, and the effect on the subsequent padi crops could not be determined as no proper experimental layout was at that time possible. Nevertheless, comparison with surrounding areas gave no indication that such cultivation would reduce padi yields.

Between 1935 and 1938 further off-season crops were grown and some satisfactory yields of vegetables obtained, but it was not until 1939 that an experiment on the growing of off-season crops was laid down. Unfortunately the majority of the records of these experiments were lost during the Japanese occupation and the following account is composed partly from the few records which have been recovered, and partly from my memory of the experiments carried out from 1939 onwards.

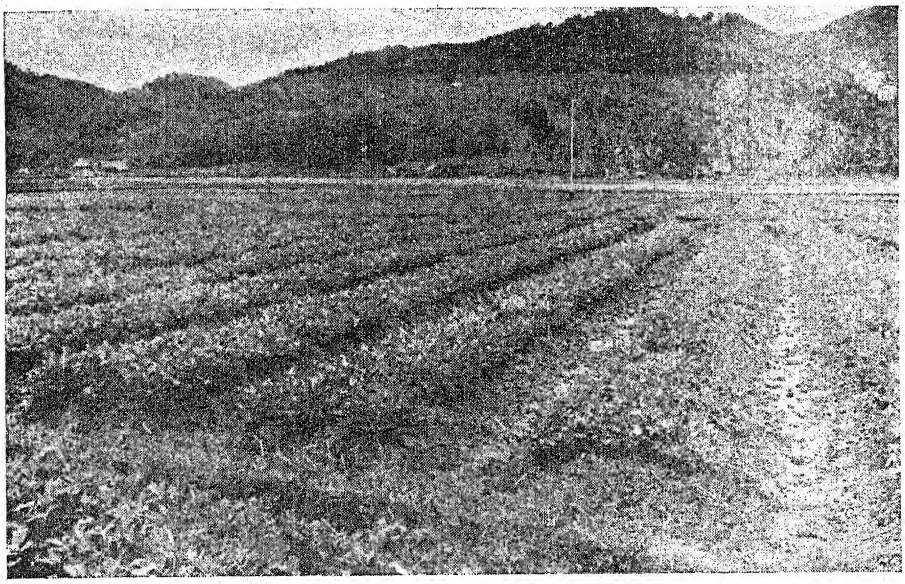
Off-season Crops grown by Chinese & Malays in P. Wellesley and Penang.

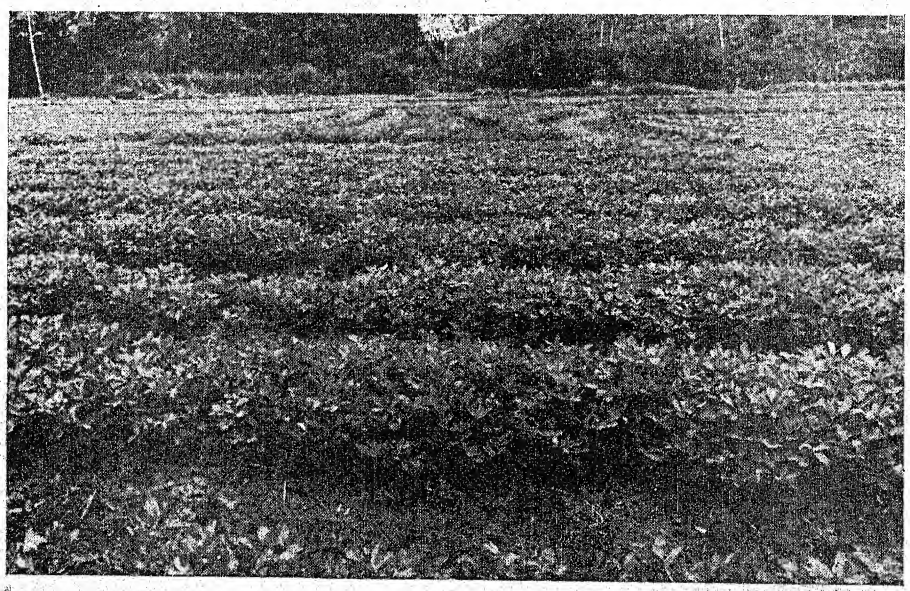
The practice of growing off-season crops was, before the war, confined to certain small and scattered areas. At Tassek Junjong in the Southern District of P. Wellesley a few Malays made a practice of growing sweet potatoes. No manure was used, low yields were obtained and it was held by many of the padi planters in the district that areas which had supported sweet potatoes during the off-season for two or three years showed the poorest padi yields in the area.

In the Northern and Central districts of P. Wellesley, many Malays planted vegetables in scattered areas of padi land adjoining the kampong land. The crops were chiefly cowpeas, ladies fingers, chillies and sometimes sweet potatoes, and they were usually manured with goat or poultry manure or, less often, with buffalo or cattle manure. In 1941, about 25 test cuttings were made on the subsequent padi crop on plots which had supported vegetables and, in each case, on an adjoining plot which had not grown vegetables. In almost every case the cutting from the vegetable plot showed the higher yield.

In the area around Relau, on the eastern side of Penang island, Chinese padi planters have been in the habit, for many years, of planting crops of groundnuts and sweet potatoes, and sometimes other vegetables, during the

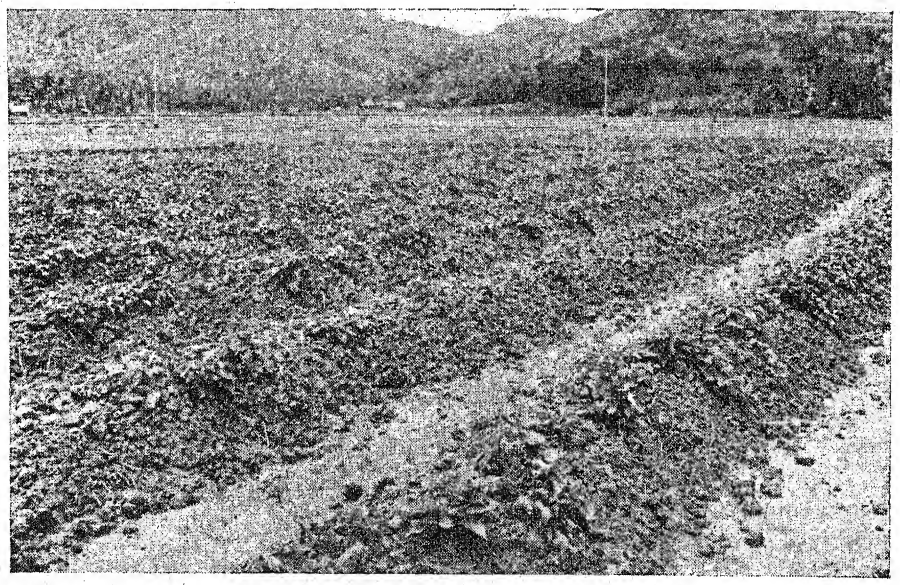
PLATE I.



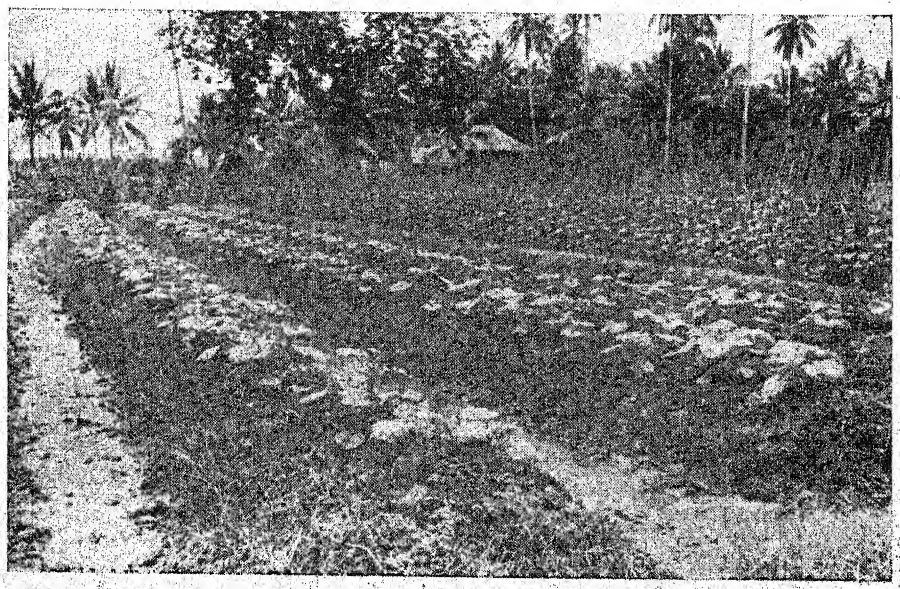


Groundnuts growing on Padi fields at Relau, Penang.

PLATE II.



Sweet Potatoes.



Ladies fingers and Cucumbers growing on Padi Fields at Relau, Penang.

off-season. In some fields a crop of groundnuts is planted immediately after harvest in late January or early February, and is followed by a crop of sweet potatoes in April. The sweet potatoes are still on the land while the padi for the following crop is growing in the nursery, and transplanting of the padi takes place immediately the sweet potatoes are harvested. Before the war, the groundnuts received a heavy dressing of lime amounting to 15 katis per 50 ft. bed. (about 26 piculs per acre) but there is evidence that, with the higher price of lime, there has been a reduction in the quantity used. The maximum dressings now given are about 17 piculs per acre but more usual ones are 12-14 piculs per acre. The sweet potato crop often receives no manure but may be given cattle manure before planting or prawn dust, applied to the top of the ridges, after planting. On the lower parts of the padi fields, two crops of sweet potatoes are sometimes taken instead of one crop each of groundnuts and sweet potatoes. In this case the first crop is not manured but the stubble is turned into the ridge, while for the second crop either cattle manure or prawn dust is applied. Other vegetables, such as ladies fingers, are occasionally planted in place of the groundnut or sweet potato crops, in which case the usual application of prawn dust is made. There have been no tests carried out on the effect of these crops on the subsequent padi yield, but the opinion of the padi planters themselves is that there is no appreciable effect, and certainly the padi crop in the area has shown no obvious signs of deterioration or improvement compared with adjacent areas not so tested. Plates 1 and 2 show areas of padi land in Penang under groundnuts and under sweet potatoes and vegetables. Test weighings carried out in 1941 on the groundnut crop in these areas showed that yields of about 10 piculs per acre of dry, unshelled nuts were obtained.

Analyses of soil samples from plots which had grown groundnuts and from adjacent plots which had not grown any off-season crops showed that the heavy liming had considerably increased the CaO content of the soil, and there was a suggestion that the available phosphate content had also been raised. The analyses are shown in Table I. The plot from which sample 1 was taken had almost certainly, from its position in the field, grown groundnuts for longer than any of the other plots.

Table I.

Analyses of Soil Samples from Padi Land at Relau, Penang.

N/2 Acetic Acid Extract. Parts per million.

			CaO		K_2O		P_2O_5	
	Sample No.		0–6″	6″–12″	0–6″	6″–12″	0–6″	6″–12″
Samples from Groundnut plots ..	1		900	516	57	29	48	20
	2		564	252	47	20	23	14
	3		457	399	48	15	14	15
		Mean	640	389	51	21	28	16
Samples from fallow plots	4		339	245	27	20	21	12
	5		421	237	49	66	14	24
	6		298	183	50	40	12	19
		Mean	353	222	42	32	18	18

Off-Season Crops at Bukit Merah Padi Test Station 1935 - 38.

During the off seasons of 1935, 1936 and 1938 vegetables were again grown at Bukit Merah and Table II shows the yields obtained in these trials.

Table II.

Off-Season Vegetables at Bukit Merah 1935 to 1938.

Crops planted	Manure	Yield in lbs. per acre (to nearest 10 lbs.)		
		1935	1936	1938
Brinjal ..	Buffalo manure	2,210	3,160	
Chillies ..	1935 3 tons/acre	2,210	140	
Ladies Fingers ..		1,660	7,070	Crops failed owing to flooding of the land in May.
Cowpeas ..	1936 10 tons/acre	2,210	6,140	
Groundnuts ..	1938 8½ tons/acre	828	—	
Groundnuts—Lime..	20 piculs/acre	1,100	—	

The much higher yields in 1936 are thought to have been due to the higher application of buffalo manure and to more favourable weather conditions. Groundnuts were also grown in 1936 but were harvested prematurely owing to heavy rain flooding the plot. No crops were grown during the 1937 off-season. The padi yield, at harvest in 1937, of the plot which had grown vegetables in 1936, was 634 gantangs* per acre which is exceptionally high for Bukit Merah where the average yield of all fields, in a good year, is about 480 gantangs per acre. The yield of the adjoining plot which had not supported vegetables was 452 gantangs per acre. In 1939 the plot which had had vegetables growing on it in the 1938 off-season yielded 654 gantangs per acre. No conclusion can, of course, be drawn from these figures, but the indication that high yields could be obtained following the cultivation of off-season crops led to the laying down of the experiments now to be described.

Off-Season Crop Experiments at Bukit Merah Padi Test Station 1939 - 41

The Bukit Merah Padi Test Station lies rather to the south of the centre of an area of some 30,000 acres of padi land in the Northern and Central districts of P. Wellesley.

In 1939 two 4 x 4 latin squares were laid down with the following four treatments.

1. Control. Normal fallow.
2. No cultivation, but 5 tons cattle manure applied at time of planting vegetables on the other plots.
3. Vegetables planted without manure (ladies fingers and cowpeas).
4. Vegetables planted with 5 tons per acre cattle manure (ladies fingers and cowpeas).

* 1 gantang padi = 5 3/5 lbs. padi.

The vegetable plots were ploughed and harvested and beds were prepared during the last week of March. Seeds were sown on April 3rd. Each plot was 32 ft. by 24 ft. and, where vegetables were planted, there were three beds each of ladies fingers and cowpeas. The record of the vegetables harvested from one of the latin squares (Square A) is shown in Table III.

Table III.

Vegetables at Bukit Merah 1939—Square A.

	Yield per plot lbs.		Yield per acre lbs.	
	Manured	Unmanured	Manured	Unmanured
Ladies Fingers	18.84	0.84	2,138	96
Cowpeas	26.33	3.34	2,990	382

It is clear from the above table that the soil at Bukit Merah must be manured in the off-season to produce any worth while yield from vegetables of this type. Vegetable yield figures from Square B, which contained the same treatments, have not been recovered but they were similar to those in Square A.

Subsequent Padi Crop in 1939 - 40 Season.

The subsequent padi crop from all plots in both squares was recorded at the 1940 harvest. Unfortunately none of the yield figures have been recovered but in the separate analysis of the two squares, and in the combined analysis, there was a substantial and significant increase in yield due to cultivation i.e. the yield from treatments 3 and 4 above was significantly greater than from treatments 1 and 2. The smaller increase of yield of the manured plots over the unmanured was insignificant in Square A but significant in Square B, and the combined analysis, i.e. the combined yield from treatments 2 and 4 was significantly greater than that from treatments 1 and 3. In a short account which was attached to the results of this experiment it is stated, however, that this latter result must be treated with some reserve owing to the low yield of one of the cultivated unmanured plots, in Square B, which was thought to be due to an attack of 'penyakit merah'* in the centre of the plot. Little or no increase of yield due to manure was shown on the uncultivated plots. The account mentioned above states "The results clearly show that, for the first year after vegetable growing, the yield of padi is considerably increased by the *cultivation* of vegetables. With regard to the lesser, but significant, increase due to manure in Square B, and consequently in the combined analysis, this result must be accepted with some reserve owing to the unaccountably low yield of plot 15..... From the general trend of the figures, however, it seems that whereas cultivation, with or without manure, has a marked effect, manure may have a slight effect when combined with cultivation."

* a physiological disease.

Off-season vegetables, 1940.—Square A was replanted with vegetables in the 1940 off-season, while Square B was left fallow for the purpose of determining whether there would be a residual effect from growing vegetables in 1939 carried over to the 1940-41 padi season. The vegetable used in Square A was sweet potatoes and the manured plots received 5 tons buffalo manure per acre. The yield figures have been lost, but it is remembered that the yield on the manured plots was exactly double that on the unmanured plots, the former yielding at about 3 tons per acre.

Padi crop 1940-41 season.—Yield figures for the padi crop on Square A, which had now supported vegetables for two off-seasons, have not been recovered, but the results were similar to those for Square A at the 1940 harvest, i.e. a significant increase in yield due to cultivation was shown while there was a small increase in yield of the manured, cultivated plots over the unmanured, cultivated plots.

Yield figures for Square B, recorded to detect any residual effect from vegetable cultivation in 1939, are shown in Table IV.

Table IV.

Yield of Padi in 1941—Square B.

Treatment in 1939 off-season	Yield per plot 32′ x 24′	Yield in gantangs per acre
1. Control. Usual fallow	44.0	467
2. Fallow and 5 tons cattle manure per acre	45.3	480
3. Cultivated. No manure	45.0	477
4. Cultivated. 5 tons cattle manure per acre	43.5	461

It is clear that the effect of growing vegetables in 1939 has not lasted into the second season. No difference in growth was apparent during the growing season.

Off-season vegetables, 1941.—Square A was replanted with vegetables (Cowpeas) in the off-season of 1941, 5 tons per acre of buffalo manure being applied as usual to the manured plots. No yield figures have been recovered but it is remembered that the plot yields were similar to those for cowpeas in 1939.

Padi crop, 1941-2.—Yield figures could not be obtained owing to the war, but from observation during the growing period it appeared that exactly the same results would be obtained as in the previous two seasons. The crop on the cultivated plots looked much better than on the fallow plots. No difference was noted between the manured and unmanured plots on either the fallowed or cultivated land.

Experiment on Groundnuts at Bukit Merah During the 1941 Off-Season.

It was decided in the 1941 off-season to start experiments with groundnuts as an off-season crop and to follow the subsequent yields of groundnuts grown with different manurial treatments. Groundnuts grown

with lime in 1935 and a small plot planted at Bukit Merah in 1940 using buffalo manure had given fair crops. The method used by Chinese at Relau in Penang has already been described, and the lime dressing applied by them was introduced as one treatment in the experiment.

The experiment was laid out in six randomised blocks with two main treatments.

1. Groundnuts planted on beds.
2. Groundnuts planted on the flat.

Each plot was divided into 4 sub-plots with the following manurial treatments.

(a) No manure.
(b) Buffalo manure, 5 tons per acre.
(c) Lime 26 piculs or 31 cwt. per acre.
(d) Lime and buffalo manure at rates in (b) and (c).

The harvested area in the sub-plots was 24 ft. x 15 ft. Spacing was 18" x 12" and, in the plots where the groundnuts were planted on beds, there were, in each sub-plot, 3 beds of 3 rows at the same spacing.

The experiment was planted between February 18th and 24th and harvested between June 18th and 20th. Growth was quicker on the plots with beds than on the ploughed plots and the appearance of the plants was better until the middle of the third month, after which there was no noticeable difference. Plots with buffalo manure at first looked better than those with lime, but this was reversed after two months when the buffalo manure plots began to look yellow and stunted. The plots with buffalo manure and lime did not appear appreciably better than those with lime alone although the yield was higher. One more weeding was necessary on the ploughed plots than on the plots with beds.

The mean yield per sub-plot and the yield per acre are shown in Table V. The difference in yield between groundnuts grown on the flat and on beds was quite insignificant. All differences between manurial treatments were significant ($P = 0.01$) and the interaction between cultivation and manurial treatments just reached significance at $P = 0.05$. The only interpretation that can be put on this latter result is that buffalo manure is rather more effective on the plots with beds than on the ploughed plots, while lime is more effective on the ploughed plots than on those with beds. The percentage of kernels to whole nuts was 73% or 74% for all treatments.

The general conclusion reached from this experiment, with 1941 prices, was that the lime repaid application at the above rate and that it was worth while applying buffalo or cattle manure, if readily available, from the cultivators, own stock but not if it had to be bought.

It had been intended that the subsequent padi yield from the plots in this experiment should be recorded, but unfortunately war broke out just before the padi reached the flowering stage. The growth of the padi in the plots showed quite distinct differences, the limed plots showing much more vigorous growth than those which did not receive lime. There was no apparent difference between the plots receiving and not receiving buffalo manure.

Table V.

Groundnut Experiment at Bukit Merah 1941.

Yield of Dried Unshelled Groundnuts in lbs.

Main Treatments	Mean yield per sub-plot 24 ft. x 15 ft.			Yield per acre		
	Plough	Beds	Total	Plough	Beds	Total
Manurial treatments. Control ..	1.82	2.13	1.97	220	258	238
Buffalo manure ..	3.94	4.98	4.46	477	603	540
Lime ..	7.11	6.77	6.94	860	819	840
Buffalo manure & Lime ..	8.77	8.61	8.69	1,061	1,042	1,051
Mean: ..	5.41	5.62	5.52			

Discussion.

Experiments laid down at Bukit Merah have shown that the cultivation of the soil in the off-season leads, in the first few years, to increased padi yields. On this type of padi soil it is found that satisfactory off-season crops can be obtained from groundnuts by application of lime, and from sweet potatoes, ladies fingers, brinjals and cowpeas by applications of cattle or buffalo manure. Unless such manuring is undertaken little or no crop can be expected. Nevertheless it appears that, in the first few years, it is the cultivation for off-season crops, and not the manuring, which produces the subsequent increased padi yield, though it is possible that liming for groundnuts may also lead to an increase. Experiments are needed and are being laid down to follow the effect, on the padi crop, of off-season cropping over a longer period and also to determine whether smaller dressings of lime, than those applied by Chinese growers before the war, will be sufficient to maintain the yield of the off-season groundnut crop.

It is essential, if successful off-season crops are to be grown, and this applies particularly to groundnuts, that it should be possible to run off rapidly the surplus water from the March to May rains. In the Relau district of Penang the Chinese chose the higher portions of the padi fields from which excess water is easily removed. At Bukit Merah, where drainage is not so rapidly effected, off-season crops have been cultivated for eight years. In one year all crops were a total failure owing to flooding of the area, while in another year the groundnuts had to be harvested prematurely owing to heavy rain in May. It is clear, therefore, that in the successful cultivation of off-season crops drainage works have an important part to play.

Reference.

1. Baker, J. A. Fallow Crops on padi land in Province Wellesley, M.A.J. Vol. XXIII (1935) page 280.

MANILA HEMP (*MUSA TEXTILIS*)

BY

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Manila hemp, or Abaca fibre, is obtained from *Musa textilis*, which belongs to the Natural Order Scitamineae. All species of *Musa*, i.e. wild and cultivated bananas, contain a fibre, but only the fibre obtained from *Musa textilis* is of commercial value.

The plant has banana-like growth, reaching under ideal conditions an overall height of 33 ft. The part commonly referred to as the stem is really a false stem consisting of the bases of the closely packed leaf sheaths, which grow from the fleshy root stock; it is cylindrical and when mature may reach a height of 20 ft. When the plant is nearing maturity the flowering stalk is pushed up from the root through the centre of the leaf sheaths or false stem.

Manila hemp is indigenous to the Philippine Islands, in which country it is one of the more important agricultural products. The fibre, which is produced in the stem, is of excellent quality, superior to other fibres of its class in strength and resistance to sea water. For this reason it is particularly adapted for use as marine ropes.

Three varieties have been introduced from the Philippine Islands and are now established in Malaya. These varieties produce a fibre which is superior in quality to the local type.

(i) *Var. Tangongon.* A tall hardy variety which grows to a fair size even when conditions are not wholly favourable. The percentage of fibre to stems grown at Central Experiment Station, Serdang, is 1.9 per cent. to 2 per cent.

(ii) *Var. Bagulanon.* Not as hardy as Tangongon but at Serdang produces a higher percentage of fibre, 2.25 to 2.3 per cent.

(iii) *Var. Baguisanon.* Produces a low percentage of fibre, 1 to 1.50 per cent., and is not very successful at Serdang.

Manila hemp has been cultivated in Malaya only under experimental conditions by the Department of Agriculture and by a few European-managed estates. In general the Malayan climate is suitable, but plantations should not be subject to high winds which tear the leaves to ribbons. A moist atmosphere is essential. Such conditions are usually found along the foot of hills and in river valleys, but can be artificially obtained by growing a shade tree such as *Gliricidia maculata*. This interplanting promotes a moist atmosphere around the plants which appears to be favourable.

Manila hemp requires a copious and continuous supply of soil moisture, but the land must be well drained, since water-logged soils are not

tolerated. The crop also requires a rich loam soil of lasting fertility since it occupies the land for periods up to 14 years without replanting. The best soils are volcanic or rich alluvial. Volcanic soils unfortunately are scarce in Malaya but suitable alluvial soils are available in river valleys.

The values of soils for Manila hemp production in the Philippines and British North Borneo are indicated by referring to them as 10 cwt., 15 cwt., or 1 ton soils, these weights being the probable yields of fibre per acre per annum. In general, 10 cwts. of fibre per acre per annum covers only the cost of production. Ordinary Malayan soils are unlikely to yield much more than 10 cwts. per acre, and it is therefore advisable to grow the crop only on the most fertile soils.

Moderate success has been obtained at Serdang on virgin, laterite soils by growing the plants in valleys at the foot of low hills, but these areas have had the assistance of applied chemical fertilizers. Better success has been obtained on the coastal alluvial soils, although heavy clay soils are not usually recommended for the crop. It should be noted, however, that all these plantings have been on small experimental areas.

The use of farm-yard or artificial manures may be economical in promoting increased yields, but it must be appreciated that manuring cannot raise soil fertility on poor soils to equal that of inherently rich lands, and it is necessary to emphasize that this crop demands soils of high fertility.

Planting Material.

Manila hemp is usually propagated by suckers which are produced freely at the base of the parent "stem," whence they can be removed easily without interfering with the further growth of the plant. Another method is by divisions of the rootstock, but as this necessitates the removal of the entire parent the method is not economical unless it is desired to uproot and replant an area, or extend plantings.

Disease and Pests.

The stands of this crop at the Central Experiment Station, Serdang, although exposed to banana diseases such as Panama Disease, *Fusarium cubense*, and Banana Leaf Spot, *Cercospora musae*, have to date shown no signs of being affected with either fungus. A fungus, *Marasmius semiustus* sometimes attacks the leaf sheaths but the recorded occurrences have been few and the attack is only extensive on backward plants. "Bunchy-top," a virus disease capable of doing appreciable damage, has not been recorded in Malaya.

The weevil *Cosmopolites sordidus*, Germ, has been recorded as attacking the stems, but the attacks have not been serious. The caterpillar of the skipper butterfly, *Erionota thrax*, rolls the leaves on which it feeds; its presence is conspicuous but the damage does not appear to be of importance.

Planting, Cultivation and Harvesting.

Suckers are planted out in the field at a spacing of 8 to 12 ft. apart. Holes 2 ft. each way should be dug to receive the suckers. Before planting,

the holes should be filled in with surface soil from the vicinity. At planting time, a small hole just big enough to take the roots is made in the centre of the prepared hole and the suckers placed therein. The soil is then well rammed down all round the plant. During subsequent growth, every effort should be made to keep up the organic content of the soil by the methods most suitable to the particular locality, such as cover crops in the early stage, selective weeding, and later by trash in the form of dead leaves, factory and stripping refuse placed as a surface mulch around the plants.

The shade tree *Gliricidia maculata* should be planted at double distances to the manila hemp, i.e., the manila hemp is planted at 12 ft. square intervals and the shade is interplanted at 24 ft. intervals and between alternate rows of hemp. The *Gliricidia* should if possible be established before the Manila hemp suckers are planted, and it may be pruned at the beginning of the wet seasons if it is overtopping the hemp plants; the prunings should be laid around the hemp plants as a mulch and green manure.

The number of suckers permitted to develop at each stool will depend on soil fertility. On very fertile soils as many as nine per annum may be allowed to grow; on soils of lower fertility, one every two months is probably the limit that can be expected to develop with sufficient vigour to grow to the minimum height of 8 ft. to the base of the leaves. Suckers should be allowed to grow only on the perimeter of the stool in order that they can draw on a wider range of soil for their nutrients and water; suckers growing in the centre of the stool are usually less vigorous.

The first stems should be ready for harvesting between 21 and 24 months after planting, by which time the stool should consist of from 12 to 25 stems. The stems should be harvested just before or as soon as the flowering stalks appear; this is indicated by the development of an arrow-shaped "leaf" at the apex of the plant i.e. the flowering stem sheath. Stems should be cut as close to the ground as possible. Care should be taken that a sloping cut is made, otherwise rain will collect on the cut surface, favouring the ingress of fungi and bacteria which cause rotting and which may injure the root-stock and the remaining " stems " in the stool. Under good conditions each stool should yield as many as three " stems " every four months for 10 to 14 years. The minimum height of a stem suitable for harvest at flowering is 8 ft.

It is claimed by Malays in the planting of bananas (*Musa sapientum*), and in British North Borneo in the planting of Manila hemp (*Musa textilis*), that 'eyes' make the best planting material.

'Eyes' are the undeveloped buds which eventually grow into suckers; they are manifested by swellings at the base of the large pseudo-stems below ground level.

Well grown suckers removed from the parent stool and replanted often make only a stunted growth, possibly due to the severence of their roots; it is only after the suckers have produced a secondary 'stem' that a normal vigorous growth takes place.

This causes a loss of time between planting and harvesting, whereas if 'eyes' are planted there is no check in the growth of the first pseudo stem which appears above ground.

'Eyes' may be obtained by severing from the main stool the stumps of pseudo stems which have, in harvesting operations, been cut to ground level; it is necessary to take a fair amount of the parent stool to provide sufficient food material for the rapid development of the 'eye'.

Should large quantities of planting material be required it would probably be necessary to uproot an area and divide the stools.

Method of Preparation.

In order to obtain the best results, it is imperative that the fibre is extracted with as little delay after cutting as is possible.

The first process is stripping each stem into its component layers until the central flowering stem is reached. This is done with the help of a pointed knife by removing the outer layers of the leaf sheath in strips 2 to 4 ins. wide running the whole length of the sheath. The outer leaf sheaths contain a coarse and stronger fibre than the inner while the fibre from near the middle is of a fine silky texture. The inner layers of each leaf sheath is discarded since it contains little fibre. This preliminary stripping process may be done in the field to avoid bringing excess bulky material to the central stripping shed, but the strips must not be allowed to dry out; if any delay is occasioned it is advisable to cover the strips or store them in the shade until they can be transported to the factory.

The second process consists of removing the pulpy part of the strips from the fibre and this is done with the aid of a simple machine*. The machine can be modified in various ways to suit hand or power operation but, basically, it is as follows:—

A firm foundation is made on which is fixed a lever carrying a blunt knife in such a way that it can be raised or lowered by a foot treadle. When lowered it is kept in contact with a wooden block at a constant and adjustable pressure. The knife is raised to insert the strip then lowered and the strips are pulled through. The strips are again pulled through but this time in the reverse order, to clean that part which was held by the operator during the first "pull through." The fibre so produced is sorted into grades according to colour and length of fibre and hung to dry on poles supported at each end by rails. If possible, drying should be carried out in the shade since full sun drying causes the fibre to develop a yellowish straw colour.

Although the above operations appear simple, care must be taken to ensure that they are properly performed, as the manner in which this work is done affects the quality and quantity of the fibre produced. If the knife

* The "Hagotan" hemp stripping machine was marketed in the Philippine Islands and British North Borneo before the war.

edge is not smooth, or the pressure insufficient, some of the pulp will be left on the fibres; if the pressure is excessive a percentage of the fibre will be discarded with the pulp and the tensile strength may be reduced.

The percentage of fibre in the " stem " varies between 1 and 2 per cent. by weight depending on variety and conditions of growth.

Commercial Valuation.

In December 1946, the Department of Agriculture forwarded three samples of fibre, each of 10 lbs. weight, prepared at the Central Experiment Station, Serdang, from Manila hemp plants grown on the Station, to the Imperial Institute, London. The following extracts are taken from the report on these samples by the Plant and Animal Products Department of the Imperial Institute.

Varieties.—Bangulanon, Baguisanon, Tangongon. The samples were, on the whole, well cleaned except for a small amount of dark fibre and unseparated strands. The colour was generally good and lustrous being light to dark cream with a small amount of brownish, harsh fibre. The strength on the whole was very good, with little difference between the three samples.

Length of fibres:—Bangulanon 7 to 8½ feet
Baguisanon 6 to 8½ feet
Tangongon 6 to 8½ feet with a small amount 5 feet.

Chemical Examination of the Sample of Bangulanon Compared with 3 Grades of Commercial Manila Hemp.

	Present sample %	Commercial Samples		
		F %	C %	L1 %
Moisture	9.8	10.7	10.6	8.9
Calculated on the moisture-free fibre ash ..	0.7	1.5	1.9	3.2
(a) Hydrolysis (1% Na_2O Soln for 5 minutes) ..	11.5	13.4	12.3	12.9
(b) Hydrolysis (1% Na_2O for 60 minutes) ..	17.6	20.2	19.2	19.3
Water Washing Loss ..	1.2	2.4	3.5	5.3
Cellulose ..	78.4	76.9	74.5	74.8

The ultimate fibres of this sample were found to have the following dimensions compared with commercial Manila hemp.

	Length in mm.			Diam. in mm.		
	Max.	Min.	Av.	Max.	Min.	Av.
Present Sample ..	6.5	3.4	4.6	0.025	0.01	0.017
Commercial Manila hemp	12.0	3.0	6.0	0.032	0.016	0.024

The chemical examination shows the Malaya-grown Manila hemp (Bangulanon variety) to have a low ash content and a high cellulose content, and to suffer low hydrolysis losses in comparison with the three grades of commercial Manila hemp quoted above. The results are very satisfactory.

The samples were submitted to two firms of fibre merchants, whose representatives are members of the Imperial Institute Consultative Committee on Vegetable Fibres. Extracts from their reports are given below.

"1. Bangulanon. Good length, fine, soft, well cleaned fibre, good sheen, strength excellent. To-day's value of this fibre is £145 per ton c.i.f. United Kingdom.

Baguisanon. To-day's value £135 per ton c.i.f. United Kingdom. With a little more cleaning this could easily be equal to Bangulanon.

Tangongon. To-day's value £130 per ton c.i.f. United Kingdom. Strength good, too much strippy fibre.

All three samples would to-day find an excellent market owing to the world shortage of fibres. To-day's prices are very much inflated owing to the world shortage of all hard fibres and it would not be safe to count on getting these prices in 1948 and 1949. The pre-war values were about £26 per ton c.i.f. and the span between the different qualities would naturally be much less than on to-day's values.

Undoubtedly there would be a very good market for this class of fibre and it would compete favourably with any fibre produced in other parts of the world.

2. Bangulanon, soft, excellent spinning quality, varying from Davao "E" to Davao "J2" equivalent, averaging Davao "I" to Davao "S2".

Baguisanon, average between Davao "I" and Davao "S2" equivalent.

Tangongon, strength satisfactory: mixed, varying from Davao "F" down to Davao "L1" equivalent. Given more careful preparation—should average at least Davao "J1" equivalent.

Conclusions.—All three samples compare favourably with the commercial Manila hemp grades mentioned above. The sample of Bangulanon variety was the best of the three present samples and was valued at £130 to £145 per ton. All the samples would be readily saleable but the prices given in the valuations are exceptionally high. They represent the current values but it is not possible to say how long the market will continue at this level."

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UBI KEMILI, (COLEUS TUBEROSUS.)

BY

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Little information has so far been published in this country regarding this vegetable, which is popular in Province Wellesley, and has been grown experimentally on a small scale at Bukit Mertajam Agricultural Station. The information thus obtained is now recorded in order that attention may be directed to this useful root crop.

" Ubi kemili " is the local Malay name* for this low-growing herb, which does not appear to have an English name. It is known botanically as *Coleus tuberosus* and belongs to the family Labiatae. The stems and leaves are thick, juicy and faintly fragrant. The flowers are small, pale violet in colour, and are produced on an elongated terminal raceme. The dark brown tubers are borne in clusters at the base of the stems. An illustration of the tubers appears in " Vegetable Gardening in Malaya " page 82, published by the Department of Agriculture in 1941, and on page 132 of this Journal.

Propagation.

Stem cuttings and tubers are used for propagation but only tubers are planted in Province Wellesley. The latter are selected from the cultivators' crop harvested previously or purchased from other growers. The tubers are spread about one inch deep in a cool dry place and kept until such time as the 'eyes' on the tubers begin to sprout. The time taken for this to happen varies but sometimes it does not occur before three months.

Cultivation.

The crop grows best on a loamy soil which must be well drained. Water-logged conditions have a definite adverse effect on the crop, not only retarding the growth of the plants but also causing deformities to the tubers and reducing the yield considerably.

The land is changkolled over and levelled, and small drains constructed in and around the area to ensure good drainage. Small pieces of stick are fixed in the soil, 3 to 4 feet apart, to mark the points for planting the sprouting tubers. No manure is supplied. The local belief on this point is that any manure applied to normally fertile soils tends to produce deformed tubers and seldom, if ever, increases yields. On soils of particularly low fertility, burnt earth is applied, and where this is necessary the application is small, that is about two cigarette tins full per point. As land sufficiently fertile for this crop is usually available, the use of burnt earth is seldom resorted to.

* Other names used in Malaya and Java are *Kentang Kechil* (*Klichi*); *Kembili* (from the resemblance of its tubers to *Ubi torek* (*Discorea esculenta*) and *Kumbili jawa.*

The tubers are planted usually at the rate of two per point, 4 ins. to 5 ins. apart. Sometimes the number is increased to three or even four per point, spaced as already recorded, but this is said to be wasting good material as the extra number would give rise to competition and seldom result in increased yields.

In Province Wellesley planting is done at the end of the padi harvest, i.e. in February or March, and cannot be accelerated or very much delayed as it has to depend on the growth made by the tubers which have been stored for planting. Early planting would mean planting tubers still dormant, which are very liable to rot; delay in planting would result in planting, in the open, tubers with long growing stems which would suffer from exposure to the sun.

When tubers in any one point have grown and spread to form a green mass and flowers begin to appear, soil is applied sparingly to the point to cover the plants to within 3 to 4 ins. from the edge of their spread. More earth may be applied to follow the spread of the foliage, but this is said to be inadvisable as it tends to produce numerous small tubers, on the freshly covered stems, at the expense of the larger tubers already developing from near the base of the plants. This has led some growers to the other extreme of not covering the plants at all.

Harvesting.

About eight months* from planting, the crop is due to be harvested. A sure indication that the tubers are ready for gathering is that the foliage becomes yellowish and commences to wither. This may be earlier than the normal eight months, but, nevertheless, harvesting becomes necessary then, as any delay will result in loss of crop through rotting due to wet soil conditions.

Harvesting the ubi kemili crop is a popular pastime and a monopoly of the local Malay womenfolk. Cultivators therefore have little or no difficulty in getting their crops off the land. They either have their own women to do it or, more often, receive offers from women from their own or other villages who are willing to purchase their crops in situ. Digging for the tubers is a slow and tedious job; small, strong, pointed sticks being used for the purpose.

The yield of tubers sometimes exceeds one gantang (6 katies or 8 lbs.) per point, and the average for the whole area is seldom less than two chupaks (3 katies or 4 lbs.) per point. Thus with a complete stand of plants an average calculated yield of 110 piculs (1 picul—133.3 lbs.) per acre might be obtained.

Prices vary from season to season, the previous season's prevailing price was about 60 cents per gantang in the village and 80 cents in the market.

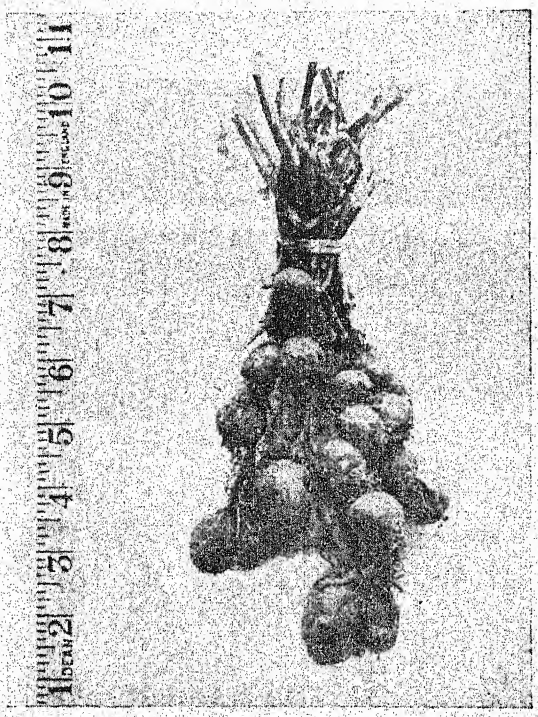
Uses

Ubi kemili is very popular among the local Malays, and is also liked by Chinese and Indians, and is consumed in various ways. It is commonly

* Crops grown from cuttings appear to be ready for harvest in four to five months after planting. [Ed.—M.A.J.].

eaten boiled with a little salt added to the water. Shredded coconut meat together with sugar makes it more palatable, whilst coconut meat juice ('santan') together with sugar, or milk with sugar, added to the cooked, cut-up tubers forms a very tasty preparation. The tubers make a good substitute for the ordinary potato in curries and they may also be fried with meat or fish to make other dishes.

Remarks.



Planting material of this crop is often limited; the space required for storage is not easy to provide so that the growers do not usually reserve more than they actually require for their own planting. The crop in consequence has been confined to permanent cultivators and to certain definite localities.

There are a number of problems that require further investigation with regard to this crop. In the first instance, the question of how best to store the 'seed' tubers in order to accelerate development of the 'eyes', to permit earlier planting, needs investigating. Exact information as to which are the best tubers for selecting as 'seed' tubers is also necessary. Opinions differ as to the number of 'seed' tubers to a point, and belief with regard to manuring is rather paradoxical. Some cultivators do not agree that covering parts of the growing plants with soil is necessary. The tuber crop is harvested just at a time when the supply of padi is becoming depleted and the ubi kemili helps to augment, for a time, the provision of rice. It will be seen that whilst there is a considerable amount of local knowledge regarding this crop there are a number of problems requiring investigation which remain to be solved by further trials.

Received for publication in March, 1947.

ANIMAL HUSBANDRY IN MALAYA

No. I. Cattle in Malaya

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Introduction.

"Animal Husbandry" may be defined as "the multiplication and management of economic animals for the production of wealth and profit." Livestock occupy a very important position in numerous countries, both temperate and tropical, and are normally kept for the production of such necessities as meat, milk and wool, and such by-products as manure, and for haulage purposes. The advent of the motor-driven truck and tractor has diminished the importance of livestock as a means of transport and haulage in many Western countries, but, in the Tropics, cattle still supply the main source of power for tillage operations and for rural transport.

The ordinary person, who is not conversant with agricultural statistics is apt to be unaware that the world trade in livestock and their products amounts to thousands of millions of dollars per annum, and that, in the British Empire alone, some 300 million people are more or less directly dependent on the land and hence, in the majority of cases, are concerned with animal husbandry in one form or another. Living in Malaya, where agriculture is largely concerned with the production of export crops, one is inclined to forget that, in many parts of the Empire, animal husbandry is more important than crop production, and that the latter is carried on chiefly with the aim of providing foodstuffs for the cultivator's animals.

In Malaya, we are naturally more interested in the types of animal husbandry practised here and in neighbouring countries, rather than in temperate countries, and the main features of this branch of agriculture in India, Ceylon, Siam and this country, are, therefore, worthy of a brief description.

India.

India has, by far, the most important animal industry in the Empire. It is estimated that there are upwards of 150 million head of cattle and 30 million buffaloes in the country. They are mainly used for draught purposes and, although their products are of comparatively little value, as draft animals they are of vital importance in the cultivation of the land. While

Mohammedans also are concerned with livestock in India and their religion does not regard the cow as a sacred animal, strong Hindu prejudices, which do so regard it, prohibit the killing or sale of cattle for food. Castrated bullocks are permitted to work, but cows can neither be worked nor slaughtered for any purpose. Female buffaloes supply most of the milk produced in India. Hindu custom affirms that cattle and buffaloes must find their own food or die. Working animals receive more attention than cows, male buffaloes, or young stock; these latter classes are often very neglected and a great wastage of stock through starvation, disease and death, takes place continuously. One of India's great problems is the excessive and inefficient cattle population. Promiscuous breeding takes place almost everywhere, with a gradual deterioration in quality. Insufficient grazing land is available to support the numbers, and this results in the production of slow-maturing animals of poor type. Such a state of affairs was not always the case. In earlier days cattle-breeding in India was largely in the hands of professional cattle-breeding tribes who, though nomadic, nevertheless kept their herds remarkably pure. Deterioration thus is of comparatively recent origin and is largely a result of the promiscuous mating of village-kept cattle.

Ceylon.

In Ceylon, religious customs have not so great a hold on the community as in India in their dealings with cattle. The climate is very similar to that of Malaya, except that parts of the Island are definitely drier and there are more pronounced wet and dry seasons. The cattle are mainly used for draught purposes but a fair trade is carried on in meat and milk. The principal difficulties are (a) insufficient grazing ground for the number of cattle kept, (b) indifference and ignorance on the part of native cattle keepers, and (c) disease, especially rinderpest and "foot-and-mouth." In the dry and padi-growing seasons shortage of grazing becomes so acute that, in many cases, resort must be had to the practice of forest browsing. Of late years, a fair amount of cross-breeding with European and Indian breeds has taken place in parts of the Island and the influence of imported animals, carrying better milking qualities, is being felt in the improvement of milk yields in individual cows. This improvement is most noticeable near the dense centres of population.

Siam.

In Siam, animal husbandry is an important branch of agriculture and a surplus of cattle and buffaloes is produced, part of which is usually exported to Malaya when the import regulations permit. During wet weather grazing is usually plentiful, but conservation of fooder is practised for and during the dry seasons. It is considered in Siam that native cattle cross well with European and Indian breeds, and improvement along these lines has received considerable attention. Pig rearing also has been emphasized, both for the home market and for export to countries such as Malaya, while in some districts horse rearing also is carried on.

Malaya.

Agriculture in Malaya has, up to the present, largely been concerned with " tree " crops, particularly rubber and coconuts, and with rice, and, because of this, animal husbandry has in the past been comparatively unimportant. Firstly, the tree crops grow well on land newly opened from jungle and their products find a very profitable world market. Secondly, there are no natural grazing areas and almost the whole of the grain crop produced is required for human consumption. Thirdly, a system of agriculture in which rice is always important, and in which the tree crops are dominant, requires very little manure for its establishment, and comparatively little power for cultivation. Finally, the above and similar reasons, in conjunction with a peasantry which has no natural bias towards livestock farming, undoubtedly explain the present inadequate position of animal husbandry in this country.

On the other hand, there has been for a considerable number of years a comparatively heavy importation of livestock and livestock products into this country, as shown in Tables I and II. It will be seen that the average value of net imports of livestock, and of livestock products, amounts to approximately 20 million dollars per annum, and that even this large figure does not include minor imports, such as those of draught animals. Table III shows the number of animals in Malaya at the end of 1940.

As to the future, three inter-dependent fundamental facts must be kept in mind:—

(a) Malayan prosperity in the past has been built on exports of a limited number of crops, such as rubber and coconuts, and tin. Tin has aptly been described as a " wasting asset ", and past slumps indicate that world markets for local export crops are notoriously fickle. The possibility of increasing substitution of artificial products for natural substances, for example, in the case of rubber, also cannot be ignored. Remembering that most of our present export crops cannot be eaten, we see from the above that, in times of slump, Malaya's income is seriously diminished; this in turn, leads to diminished imports, including those of foodstuffs for the human population, and this means for the majority of the population a lowering in the standard of nutrition.

(b) Since the world market is not subject to local control, it would appear from the above that three things are desirable:—

(1) That the range of export crops should be broadened, to avoid undue reliance on a few only.

(2) That Malaya should produce increasing quantities of food crops, particularly rice, rice substitutes e.g. root crops, legumes, and maize, and fruit, with a view to diminishing the present dependence on imported supplies.

Table I.

Livestock for Food

Net Imports and Value (nearest thousand).

Year	Cattle		Goats		Sheep		Swine		Total
	No.	Value	No.	Value	No.	Value	No.	Value	
1926 ..	45,000	$3,546,000	27,000	$ 463,000	57,000	$ 732,000	223,000	$5,597,000	$10,339,000
1930 ..	31,000	2,801,000	22,000	388,000	44,000	596,000	181,000	4,528,000	8,313,000
1934 ..	45,000	1,928,000	7,000	88,000	52,000	371,000	160,000	2,732,000	5,119,000
1938 ..	19,000	968,000	15,000	156,000	60,000	539,000	96,000	1,461,000	3,123,000
1940 ..	25,000	1,697,000	29,000	370,000	61,000	597,000	123,000	2,084,000	4,749,000

Table II.

Livestock Products and Poultry.

Value of Net Imports (nearest thousand).

Year	Meats	Milks	Butter	Poultry & Eggs	Total
1926 ..	$ 1,474,000	$12,606,000	$ 991,000	$ 1,430,000	$16,502,000
1930 ..	2,008,000	11,620,000	1,054,000	2,385,000	17,067,000
1934 ..	965,000	6,341,000	583,000	997,000	8,887,000
1938 ..	1,645,000	9,132,000	1,014,000	1,671,000	13,462,000
1940 ..	1,896,000	11,432,000	1,111,000	2,481,000	16,920,000

(3) That local animal husbandry also should be encouraged to develop beyond its present backward state, partly to reduce dependence on imports and partly to provide manure, as explained below.

(c) Any attempt to stabilise the prosperity of Malaya along the lines suggested in (b) (1) and (2) above is at present inhibited by poor soil fertility—" the basic factor controlling Malayan agriculture is the relatively low fertility of soils throughout the Peninsula." In the main, this fertility can best be maintained or improved by the development of systems of agriculture in which livestock, with its production of manure, plays an important part.

Table III.

Number of Animals in Malaya, 1940.

State or Settlement	Oxen	Buffaloes	Sheep	Goats	Pigs	Horses†
F.M.S.—						
Perak ..	29,044	15,050	1,558	57,548	112,709	102
Selangor ..	20,422	3,419	1,026	47,578	136,315	—
N. Sembilan	14,361	15,075	6,223	34,848	63,296	11
Pahang ..	6,457	29,922	6,599	25,867	24,596	68
Total F.M.S.	70,284	63,466	15,406	165,841	336,916	181
S.S.—						
Singapore*	4,400	1,100	2,500	3,500	145,000	200
Penang & P. Wellesley	8,096	7,219	500	10,590	60,678	170
Malacca ..	6,749	14,032	—	30,267	39,810	26
Total S.S.	19,245	22,351	3,000	44,357	245,488	396
U.M.S.—						
Johore ..	8,700	2,550	190‡	41,750	60,700	—
Kedah ..	58,414	66,744	37	42,987	49,966	44
Perlis ..	10,935	5,229	—	3,327	2,812	—
Kelantan ..	105,682	39,172	15,801	28,957	9,693	—
Trengganu*	25,000	20,000	2,600	5,900	5,000	—
Total U.M.S.	208,731	133,695	18,628	122,921	128,171	44
Total Malaya	298,260	219,512	37,034	333,119	710,575	621

‡ Excluding butchers' stocks. * Estimated. † 1939 figures.

Note.—This table was supplied by the Director of Veterinary Research and Veterinary Adviser, Malaya, in 1940.

Hence, in future, we may expect that animal husbandry will receive increasing attention in this country; firstly, for its own sake and in order to diminish present imports of livestock and livestock products, and, secondly, to permit a broadening and expansion of local agriculture. Malaya has in fact apparently reached a position experienced in the history of most agricultural countries, where the future development of agriculture *per se* is conditioned by a parallel development of animal husbandry.

The present position of livestock in Malaya has been summarized as follows:—

1. *Buffaloes* (a) *Malayan wide horned*, (Kerbau, Kerbau Sawah, Swamp Buffalo or Water Buffalo) used mainly for the cultivation of rice fields, the surplus animals being sold for meat and for use in the haulage of timber.

(b) *Indian Curly horned*, (Surti or Murra Buffalo, River Buffalo, Kerbau Sungai) used for milk production, the surplus animals being sold for meat and for transport and for use in the haulage of timber. Bred mainly by Northern Indian races, and able to withstand a poor diet.

2. *Cattle* (a) Those in the rural areas used in the cultivation of rice fields, the surplus animals being sold for meat and transport purposes.

(b) Milch cattle maintained for milk production (1) in the neighbourhood of towns, (2) on rubber and coconut estates; the surplus animals being sold for meat and transport purposes.

3. *Sheep*—Small numbers only, which are disposed of for meat.

4. *Goats*—Scattered throughout Malaya and sold for meat. A small number kept by Tamils are milked.

5. *Pigs*—Kept almost exclusively by Chinese in conjunction with market gardening and with tapioca production.

6. *Poultry*—(a) Kept by Chinese.
(b) Kept by Malays in the kampongs.
(c) Kept on Estates.

It has aptly been said that "in Malaya there is no livestock production industry, with its points interlinked: there is instead a series of several distinct industries which have no points of contact with each other or with the agriculture of the country. The position is admittedly complicated by racial, religious and political matters, as well as by this country's geological and climatic characteristics. Perhaps the greatest anomaly lies in the situation that whereas the chief rural land-owner, the Malay peasant, has at present little interest outside draught animals, and frequently not even that, the races most concerned with livestock i.e. the Northern Indians, normally graze their animals on vacant State land and roadsides. Whether or not greater integration of the disconnected livestock industries, both with each other, and with the agriculture of the country, is possible, advisable or necessary is still an open question. This question

is however receiving considerable attention in the quarters concerned and it is probable that the next decade will produce a very definite policy in this connexion."

Cattle in Malaya.

General Considerations.

It has been said that there are four purposes for which cattle are kept in the tropics:—

(a) For the work they do.
(b) For the meat or the milk they produce.
(c) For the by-products which are obtained from them.
(d) For the prestige their possession conveys.

The emphasis placed on the above varies in different parts of the tropics. In some parts of the world, for instance, a man's social standing is in direct proportion to the number of cattle he owns, and mere numbers are thus more important than is productivity. In Malaya, however, though the motive of prestige is not absent, cattle are kept chiefly for the haulage work they can perform and for their economic products, such as meat and milk and by-products such as manure.

The domesticated animals indigenous to any particular locality normally reflect the peculiarities of their environment, and certain aspects of a tropical environment should be considered at this stage. In the first place there is the great heat which animals in the tropics have to withstand. Indigenous animals in the course of their evolution have adapted themselves in a number of ways to offset this factor. One might mention short hair frequently of a light shade, or loose skin hanging in folds, providing a larger area from which heat can be radiated, as examples of adaptations which help cattle to remain comfortably cool in spite of frequently high external temperatures.

Again, in many cases as a result of centuries of development, indigenous tropical, " breeds " of animals have become adapted to the type of food afforded by their environment. Wherever one goes in the tropics, and particularly in monsoon areas, stock are normally short of food during certain periods of the year. Herbage becomes fibrous as the inter-monsoon dry seasons advance, grazing becomes scanty and it is the common experience that animals of the oxen or the buffalo type lose condition as the dry season progresses. Such rigorous conditions, in the common absence of supplementary feeding, mean that only those animals are able to survive whose digestive systems are highly efficient and which are thus able to extract the maximum of nourishment from the coarse food they obtain. Consequently tropical herds of cattle are, as a rule, both hardy and efficient in their utilization of food and are frequently of a size suited to their environment.

Dwarfing of Cattle and Buffaloes in the Tropics.

In many parts of India, Ceylon, Africa, Siam and Malaya cattle have in the course of time become dwarfed.

This dwarfing is attributed by some authorities to the evolution of a small body size to counteract the effects of the wet tropical heat. While the heat controlling mechanism of *Bos indicus* is far more efficient than that of *B. taurus*, the high humidity of the atmosphere of the wet tropics, interacts adversely on this heat regulating mechanism owing to the reduced evaporation of sweat from the skin. Small animals possess a greater skin surface to body size than large animals and it is suggested that the former may have developed along these lines partly for this reason.

Another reason put forward as a cause of dwarfing is inadequate minerals in the diet; this is in general discounted* as a result of analyses of fodders. Nutrition is suggested as probably having some influence on this meagre growth.

Dwarfing does not occur in all parts of India, Ceylon, or Malaya, but it is general in Malaya in the States of Kedah, Kelantan and Trengganu where oxen of the Kedah Siam breed are maintained, where the cattle population is much higher per unit area of land and where the animals are short of fodder during the time the padi is occupying the land.

It can be said that dwarfing occurs to a very limited extent in the western and southern States of Malaya where the cattle and buffalo population is more sparse. Furthermore the Kedah-Siamese breed of cattle if bred in the western areas develop into larger animals than those in their native States.

Some States of India are renowned for the rearing of large type, massive, draught oxen; which suggests that other factors in addition to climate have an influence on body size.

European cattle before the war, bred and reared in Singapore, are smaller than average for their breed. It is not known whether the calves received sufficient milk during the early weeks of life or what was the later level of nutrition. It is probable that the hot, humid climate of Singapore had an adverse influence on their growth. It can be stated that the level of nutrition is very low in many tropical countries where the cattle population is dense, and the peasant population too poor to permit the calves to have sufficient milk to nourish them, and, in addition, where concentrates cannot be purchased for the same reason.

It is considered that inadequate nutrition, from the time the calves are born up to maturity, associated with a high infestation of internal parasites are factors which have a fundamental bearing on the dwarfing of cattle in the tropics. In this respect the concentration of parasites is undoubtedly much higher in those areas where their hosts are numerous.

Disease.

Finally there is the question of disease. The indigenous tropical animal has to contend with a very vigorous insect population. Insects may act directly as parasites or irritants, as in the case of ticks, or they may convey protozoa which are responsible for such diseases as surra and

* Report on the Development of Cattle Breeding and milk production in Ceylon Nov. 1946. Norman G. Wright.

piroplasmosis. Tropical conditions also favour internal parasites, such as flatworms, round and thread worms, which cause widespread debility and lead not infrequently to death. While this is not the place to discuss immunity and disease resistance in their technical aspects, the general fact that indigenous animals usually posess a greater natural resistance to disease than do animals imported from a different environment should be carefully noted. *Bos indicus* or Zebu cattle, and the Chinese pig, for example, are normally troubled less by disease in Malaya than are pure-bred stock imported from Europe or other temperate regions.

Hence we see that, generally speaking animals indigenous to the tropics have slowly, and through the course of numberless generations, adapted themselves to meet the special circumstances of their environment. This adaptation is imperfect and is still proceeding, since natural evolution never ceases, and it is a result of what might be termed *natural* as distinct from *artificial* selection. The average cattle owner or cattle tender in the tropics is not acquainted with the principles of heredity and as one consequence controlled mating, with the idea of trying to breed to a definite and improved type, is still very rare. Unsuitable and very frequently immature males are allowed to mate promiscuously, leading to a host of resultant evils. As a rule, also, there is a complete absence of fencing, and as one authority puts it—"without enclosure there can be no true control of livestock."

In temperate regions, on the other hand, the artificial selection and breeding of livestock has been practised for centuries. In England, for instance, following the enclosure by landlords of the common land and the consequent development of larger farms, controlled livestock breeding developed very rapidly, leading to such famous farmer-breeders as Bakewell, Bates, and Booth, who flourished in the 18th century. It is of interest to the modern student to realize that men such as these, who contributed so notably to the establishment of improved breeding methods and herds of stock, were entirely ignorant of the modern science of genetics; for their notable achievements and progress they relied on sound common sense, frequent and personal observation, and the resultant skill of eye and hand.

The present position in most temperate countries is that highly specialized herds of stock have been evolved. Cows, for example, than can yield 30,000 lbs. of milk in 320 days, or say an *average* of 10 gallons per day, have been developed, and similar peaks of performance could be quoted in the case of other types of animals. High productivity of this kind has developed side by side with corresponding improvements in agricultural practice, and the provision of adequate housing and feeding, and we shall discuss later, in further articles, how the position of local livestock might be improved. The position, as will be discovered later, is not cut and dried and, while one can be dogmatic in some respects, there are many others in which the present state of our knowledge permits only of generalisation. For example, Malaya produces an insufficiency of grain even for the human

population, and the mountainous configuration seriously limits grazing and fodder crop areas. To what extent can livestock farming be developed under these conditions and to what extent can it be fitted into contemporary estate and small holding agriculture?. There is no precise answer to considerations of this nature at present, hence the need for a preliminary survey of the present position, and consideration of methods likely to bring about an improvement in the local livestock industry.

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(To be continued)

Selected Articles.

A REVIEW OF THE PRESENT WORLD POSITION OF THE SUPPLY AND DEMAND FOR OILS AND OILSEEDS WITH SPECIAL REFERENCE TO THE BRITISH EMPIRE

BY

FRANK E. FEHR, C.B.E.*

During the war period the imported supplies of Oils and Fats, including Butter, Lard and Margarine, must be considered as satisfactory.

If we take the pre-war years we find that the imported supplies of Oilseeds (expressed in Oil content), Oils and Fats—including Butter, Lard and Margarine—(after deducting exports which were in 1937 138,559 tons and in 1938 127,328 tons) were:

In 1937—1,332,085 tons
1938—1,462,454 ,,

During the war the imported supplies of Oilseeds, expressed in Oil content, Oils and Fats—including Butter, Lard and Margarine—(after deducting exports which, except for the year 1940 when they were 46,642 tons, were quite negligible) were:

In 1940—1,397,280 tons
1941—1,313,023 ,,
1942—1,269,186 ,,
1943—1,338,937 ,,
1944—1,314,626 ,,
1945— 927,891 ,,

From these figures you will see that the percentage reduction in imports during the war was comparatively small, showing an approximate reduction of 8 to 10 per cent., but that from an average during the war of about 1,300,000 tons and pre-war average of about 1,400,000 tons we dropped in 1945 to about 927,000 tons. That explains the present shortage of oils and fats in this country.

Throughout the war period there was a considerable diminution in the import of Butter; whereas, say, in 1938 we had an import of Butter of 175,895 tons, the war imports of Butter were:

In 1940—264,350 tons
1941—218,128 ,,
1942—134,314 ,,
1943—151,609 ,,
1944—153,201 ,,
1945—190,134 ,,

* Given at a meeting of the Imperial Institute Consultative Committee on Oils and Oilseeds on 17th May, 1946, at the Imperial Institute. Bull. Imp. Inst. Vol XLIV, No. 3. 1946.

These figures show that the war imports varied from 134,000 tons to 264,000 tons, that is, less than half the pre-war import. This diminution was mainly due to lack of imports from the continent.

On the other hand, Lard—of which in 1938 we had an import of 72,046 tons—showed a considerable increase in imports, the year 1940 being an exception when the imports were only 34,731 tons.

In 1941 they rose to				96,569	tons
1942	,,	,,	,,	218,495	,,
1943	,,	,,	,,	218,435	,,
1944	,,	,,	,,	189,209	,,
1945	,,	,,	,,	90,665	,,

The big imports of Lard during the war were the effect of Lease-Lend. When in 1945 they dropped off because Lease-Lend came to an end, we had to look elsewhere for additional supplies of Fats.

It is rather striking that when we come to 1945 the total supplies of Oilseeds expressed in Oil content, Oils and Fats (including Butter, Lard and Margarine), show a very considerable reduction, viz. as above indicated, 927,891 tons. Butter in that year kept up to the war level; on the other hand Lard showed a considerable decrease in net imports, and Oils and Fats dropped right down to 674,774 tons (without Butter, Lard and Margarine). This was, no doubt, largely due to the fact that it became necessary to divert a considerable quantity of Oils and Fats and Lard to supply those countries which had been deprived of supplies during the war.

We have to consider what are the prospects of future supplies. No doubt in due course we shall get better supplies of Whale Oil. For the 1945-46 season the quantity expected is 130,000 tons. The next catch, viz. 1946-47, I should think might easily amount to 250,000 tons. We shall gradually get back to the 400-500 thousand tons we had pre-war.

No doubt we shall now get increased supplies of Copra and Coconut Oil. The annual import of Copra pre-war averaged 105,000 to 110,000 tons. During the war the import fell off considerably.

In 1944 it dropped to 32,398 tons.

In 1945 it was rather better at 55,392 tons.

It is stated that the Philippines are shipping at present 25,000 tons a month, and during the last six months of this year it is expected they will ship 200,000 tons. There will not be much oil from the Philippines for some long time because their factories were badly damaged. No doubt the Dutch East Indies will also start shipping and there will be larger supplies from the South Sea Islands. Undoubtedly a portion of this Copra will come to the United Kingdom. The tendency is for most of the Copra to go to the U.S.A., but there will probably be a surplus which will come here.

Whereas as against this it is to be noted that our imports of Palm Kernels pre-war averaged, say, 150,000 tons a year. During the war we received a very much larger quantity.

In 1942, for instance, we received 414,415 tons
1943 ,, ,, 499,172 ,,
1944 ,, ,, 493,635 ,,

A great effort throughout the war was made to get supplies of oils and fats and oilseeds from the West Coast of Africa as the short journey presented a considerable economy in shipping.

When we come to 1945 a good portion of the Palm Kernels were sent to other destinations and the supplies to the United Kingdom dropped down to 293,083 tons. We must expect a further diminution in the supplies of Palm Kernels to this country as the tendency will be for Kernels to be shipped to a considerable extent as pre-war to other destinations. Pre-war Germany was the main recipient. Now they are going to Belgium, Holland and Scandinavia and that cuts down supplies to this country.

In Decorticated Groundnuts pre-war we had an average supply of, say, 280,000 tons. Again here during the war the supplies received in this country increased considerably, the peak year being 1941 when we had 606,909 tons. In 1945 the quantity had again dropped to 406,479 tons. Here, again, we must expect some diminution in supplies as Groundnuts will be diverted to other centres.

Soya Beans were never a very important article for this country. Pre-war our supplies were about 95,000 tons. During the war supplies dropped to a few thousand tons a year, except for 1943 when we received a fair quantity from the U.S.A., namely 28,189 tons. Manchuria produced 4½ million tons pre-war. All that supply was cut off during the war but it is presumed that in due course Manchuria will again become an exporter of Soya Beans.

As far as Linseed is concerned, pre-war our average imports were about 290,000 tons. During the war supplies increased considerably and varied from 232,100 tons to the peak year of 1943 when they were 506,998 tons. In 1945 the imports dropped right down to 142,307 tons. It is to be hoped that with normal crops in India again we shall get better supplies of Linseed from there, and that also there will be a tendency for the Argentine to have larger quantities available for export.

Pre-war our imports of Cottonseed were about 600,000 tons. During the war imports dropped very considerably, and in 1943 we had come down to 14,411 tons, and in 1944 to 10,027 tons. In 1945 we had again some increase, and the imports amounted to 41,848 tons.

It is to be presumed that Cottonseed imports will again be greatly increased. Egypt will no doubt get back to a more normal production although, undoubtedly, she will require a larger quantity for her own consumption than formerly. During the war little Cottonseed was imported as it only has an 18 per cent. oil content.

In South America, where there has been a very largely increased production of Groundnuts and Sunflower seed, there has also been a very large increase in crushing capacity. The Argentine is now able to crush

1,350,000 tons of Sunflower seed, which is a very marked advance on what she was able to crush pre-war. Her crushing capacity is as follows:

1,350,000	tons of	Sunflower seed
217,800	,,	Cottonseed
954,000	,,	Linseed

which is a very great increase.

No doubt we shall see an extension of crushing at points of production such as South America, India, Malaya, Australia and China although crushing at the consuming centre has the advantage of giving the crusher a much wider market from which to draw his raw material.

We must expect an increased consumption of Oils and Fats the world over as the demand for soap will increase, also the demand for margarine, as vitaminised margarine tends more and more to replace butter, but it should be possible to extend the production of Oilseeds to meet this demand. We have seen the enormous advance made in the production of Palm Oil in Sumatra—a comparatively new production; in 1930 the quantity produced totalled 56,000 tons; by 1938 it had reached over 200,000 tons. The U.S.A. in 1936 produced 793,286 tons of Soya Beans; in 1944 the production totalled 5,165,973 tons. Undoubtedly in South America, Africa, Australia and also in Asia there is room for an enormous increase in supplies.

During the war fresh sources of supply were created; these will tend to continue to produce, and we shall have pre-war production steadily restored.

We can expect the Whale Oil production in due course again to reach 4-500,000 tons, and we shall again get normal butter imports. Butter home production, which pre-war totalled about 40-50,000 tons, was considerably reduced during the war, but will now slowly tend to increase.

As traders, our one fear is that restrictions and pool purchasing will tend to restrain that free movement of commodities which is essential to obtain maximum supplies.

Too much emphasis cannot be placed on the necessity of inducing a free flow of merchandise (manufactured consumer goods) to producing countries in order to encourage the maximum collection and production of supplies of Oilseeds and Oils. If the producer can get actual goods in exchange for his produce, the effect on supplies is most marked.

In Borneo and New Guinea the whole labour basis has been upset. The Australian Government has introduced certain restrictions as regards labour. The Premier of Australia has had the whole matter placed before him recently, and it is hoped that something may be done.

It will need a very great effort in all these Dominions to set the wheels of production in motion again. In twelve months we should have enough oils and fats in this country to get through; at the moment the position is most acute. I shall be very pleased to give any further details if they are required.

COPRA IN EAST INDONESIA*

East Indonesia, which comprises Celebes, the Moluccas, the Lesser Soenda Islands, and the other smaller groups of islands in that region, as a whole is economically mainly dependent upon the coconut cultivation and the copra export connected therewith. Roughly speaking, three fourths of the eight million population is directly dependent upon the yield of the coconut cultivation, as is evidenced by the export figures of Macassar for 1939, in which copra represents about 80% of the volume and roughly 60% of the value of the export.

The total copra export of the Netherlands Indies in 1939 amounted in round figures to 530,000 tons, of which 315,000 was obtained from these eastern islands.

Only about 25,000 tons was copra from estates, so that copra to the extent of fully 95% is distinctly a native product.

With reference to the data given above it must be realized that the copra of the Netherlands Indies before the war represented only a small percentage of the total world supply of oil and fat containing substances. It is not very likely that this post-war position, when after a few years the market of basic materials providing oils and fats shall have become saturated, will again become more favourable. Reports on intensifying the production of oil-containing seeds in other parts of the world rather point in the opposite direction.

The consequences of the relations expressed in the above quoted figures will have to be carefully considered from the very first by the new State of East Indonesia.

Before the war the copra exported from the Eastern Islands was mainly directed to Europe, as will be seen from the following table:

Destination of the copra exported from the Netherlands Indies in 1939 (in round figures):—

	metric tons
The Netherlands and The Netherlands in transit ..	175,000
Germany	70,000
Denmark	53,000
Norway	37,000
Sweden	9,000
U.S.A. Pacific coast, in transit to Mexico, and Mexico	16,000
Singapore-Penang	125,000
Italy	13,000
Switzerland	5,000
Czechoslovakia	5,000
China	7,000
Other destinations	15,000
Total	530,000

* Dol, J. Economic Review of Indonesia, Vol. I, No. 4, 1947. (Abstract).

When, after the war began in September 1939, and more specifically in April-May 1940, this market was entirely inactive, there was no further market price for copra of the Indies. The result was that a condition of emergency set in, especially in the Eastern Islands.

To make the situation supportable, the Government established the Copra Fund which later succeeded in finding new markets for copra; but after about a year and a half the Japanese invasion, beginning in 1942, made an end of it. The production of copra for export, which in mid-1939 had already received a serious set-back, now ceased entirely, to be revived here and there only in the early part of 1946. And it is only since the second half of 1946 that this production can be said to have been resumed throughout the whole of this Archipelago.

All communication within this great complex of islands and atolls is entirely dependent upon ocean transport. From the very first the Japanese discovered that these communications were exceedingly vulnerable. It did not take long before nothing could enter and nothing could leave, so that the entire area was doomed to rely upon its own supplies. Nothing could be replenished, replaced, or renewed.

After the Japanese defeat the economic demolition of this once so prosperous region proved to have been thoroughly effective. The harbour, and also the entire business district, of Macassar had been seriously damaged through bombardments. Menado and Donggala had been totally flattened out. At Gorontalo and in many other places the warehouses and port facilities had been destroyed, whilst numerous smaller places along the coast where products were accumulated and shipped, suffered serious damage from machine gunning which caused many fires.

The native proa fleet had been halved, and in certain parts been reduced by 90%, partly through acts of the Allies, and partly also through neglect, seeing that in the course of the last year of the war not a proa ventured out.

The motorized land transport material had been reduced to a minimum, and in the interior the vehicles drawn by oxen had practically disappeared because the draft animals had been slaughtered by the Japanese. At Macassar and elsewhere the Japanese themselves had to use wooden carts, with wooden axles and without tyres, propelled by man power. Everywhere the roads were neglected, and the supplies of commercial produce, both of important and export goods, were minimal. Everywhere the people were deprived of their most necessary requirements, especially where clothing was concerned. There was complete economic disorder.

Towards the end of 1945 the Copra Fund sent out men to survey the copra situation. Although certain provisional arrangements could be made in some places, it was as yet impossible to survey the situation in its entirety, for there were no means of communication, such as by boat, post, or telegraph.

According to information received, which later proved to have been reliable, it was found that at the time of the Japanese capitulation there was

available in the Eastern Islands in total about 20,000 tons of copra, that is to say less than the pre-war monthly production. This copra was available mainly in the northern part of Celebes and in the Sangir Islands, and in part had been produced some years ago!

Thus the copra supply had to be built up again from the very start. The first step in that direction was to resume contact with the copra producing population. About the middle of May 1946 a coaster, specially assigned to this end, established contact with these people. This goodwill trip lasted about ten weeks, the coaster visiting the main centres along the coast of Celebes, as also Sangir, Morotai, Ternate, and the Banggaai island group.

The head of the Agricultural Instruction and Propaganda Service arranged for meetings with the local chiefs and the copra producers.

In many places a physician gave medical assistance, the first for years; a technician of the Telegraphic Service repaired in spots the contact with the outer world, whilst a number of Copra Fund men took the necessary measures for reaching as soon as possible a resumption of the copra export.

Everywhere a certain quantity, obviously limited, of textiles, bags, tobacco, dried fish, and money, was left as an inducement for the population to resume their normal activities.

It was only after this trip, which ended in August 1946, that there was a resumption of the copra production. In August and September the first substantial supplies of textile goods were dispatched to the supply centres. The number of bags and the amounts of money had to be increased. Wherever necessary, plans were drawn up and assigned for the construction of godowns, and paraffin oil was supplied so as to prevent coconut oil from being used for lighting purposes.

In this first period numerous problems had to be solved, the main ones being the transportation difficulties. For days and sometimes weeks the first representatives of the Copra Fund went from place to place in open proas along the coast to re-establish contacts and points of accumulation. Only recently the communications have been improved, thus increasing the activity.

One of the most difficult points was to overcome the dislike of the people to work their plots which in the course of years of neglect had become overgrown with tropical undergrowth, sometimes yards high. Also the palm trees themselves were overgrown with weeds that in their turn again harboured vermin.

As soon as the production was set going again, a new problem arose, that of fetching it, which up to this day has remained one of the main difficulties. Nevertheless there is reason to assume that before long considerable improvement will be made, also in this respect.

By the end of December 1946 the Copra Fund had established 72 offices in East Indonesia, with in all 127 points where native copra was being bought, whilst furthermore on a dozen or so estates in Northern Celebes copra was stored ready for shipment.

The personnel in this region consisted of about 650 employees. The Donggala and Sangir sections were put into working order early in 1946, under circumstances that were not altogether unfavourable, with the result that there, after a while, the production attained one half and more of the pre-war capacity. In practically all the other districts it was only in the second half of 1946 that the work could be intensified, whilst it was not until the last quarter of that year that generally speaking the activities were well under way.

The work done in 1946, and mainly in the second half of that year, towards the recuperation of the copra production and the copra export of East Indonesia is in part expressed by the following (round) figures:

		metric tons
Total quantity of copra put under control of the Copra Fund East Indonesia in 1946		102,000
of which so-called " old copra "	26,000	
and new production	76,000	102,000
Of this there was exported in 1946		50,000
Local consumption and transported to other islands		7,000
Available stocks December 31, 1946, in the Archipelago		39,000
Available stocks December 31, 1946, at points of export		6,000
		102,000

So called " inducement " textiles assigned and mainly arrived	1,500,000 yards
Gunnybags supplied and in circulation	2,000,000 units

The following figures approximately indicate the course of the production of copra, in which connection it must be stated that the data covering the first half year and partly also those referring to the third quarter of the year cannot be regarded as entirely accurate.

Approximate production 1946:		metric tons
July	6,000	
August	8,300	
September	8,200	
Third quarter		22,500
October	12,000	
November	14,000	
December	11,000	
Fourth quarter		37,000
Second half year		± 60,000
First half year		± 16,000
Total		76,000

Progression:			
1st half year			16,000
2nd half year	3rd quarter	22,500	
	4th "	37,000	60,000
		Total	76,000

It must be noted that by " production " here is meant the quantity that reached the Copra Fund, which in most districts corresponds more or less to the actual production. It must also be remembered, as stated above, that in Donggala and Sangir already in mid-1946 fully one half to three quarters of the production capacity of these districts had been reached. On the other hand, the potentially very productive region of the Minahassa had in early September not reached even one tenth of its production capacity. In this last district it was mainly the serious lack of overland transportation that seriously handicapped the collection of copra. In the course of the last quarter of 1946, however, a surprising activity manifested itself there, which made the utmost demands upon the transportation and storage facilities.

The southern Moluccan Islands and the surrounding island groups are only now, in so far as copra is concerned, on the eve of their recuperation. Inadequate shipping connections had caused these areas to remain isolated longer than the other regions, so that regular production and collection could not be effected.

It must further be mentioned that the entire intermediate trade is carried on through the normal pre-war channels, that is to say by Chinese middlemen. In certain areas this trade is almost entirely in Chinese hands, whereas in other regions, especially in the Minahassa, there is a distinct tendency towards eliminating this traditional link, and to substitute for it Indonesian co-operative associations.

The widely published fact that in the Philippine Islands the pre-war copra export, and even more than that, had already been reached in 1946, has obviously caused questions to be asked with reference to the copra production in Indonesia. But it must be realized that neither the facts nor the circumstances can be compared.

The Philippine Islands were liberated in April 1945, and were immediately put under American protection. Huge quantities of import goods, army supplies, food, clothing, vehicles etc., were available and were immediately used for assisting in the economic recovery. With the aid of these unlimited supplies also the copra production was stimulated, whilst for collecting and transporting the purchased copra throughout the Philippines swarms of large and small coasting and seafaring vessels were available and could be utilized. Thanks to this abundant shipping material the copra production in the Philippines had been entirely restored in the course of 1946.

It was only a considerable time after the capitulation of Japan that a part of the Indies was put under the control of the " allied " troops.

The chaotic political conditions that soon prevailed affected the entire country, and thus it happened that we here only could begin work about a year after the Japanese capitulation, and even then with practically empty hands, in the most literal sense of the word.

The beginning had to be made by those few who had survived the camps. Many of the experienced and expert personnel had died; many also

had to be evacuated speedily to recover their health. Every branch of service was greatly understaffed, and the young and inexperienced substitutes from Holland had too little inclination to work hard and to do without things, two unavoidable elements in overcoming a state of chaos. All recovery and every extension remains limited by the lack of experienced personnel, a difficulty which thus far has not been overcome.

Those who did put their shoulder to the wheel that first year, look back upon a year of grim effort: much energy applied with the certainty of but poor results. It was a year of disappointments and reverses. But it also was a year in which the foundations were laid on which the reconstruction could be based.

Thus it is that now the moment, we hope, is approaching when the results of much difficult preparatory work will become noticeable. Throughout this archipelago as a whole, and at Macassar in particular, conditions are such that a more definite grip can be applied to the details of the organization. The Copra Fund, which had unfolded its activities only towards the end of 1946, now begins to run more smoothly. The subjoined tabulation gives its purchasing centres:

The Copra Fund establishments in East Indonesia, as at December 31, 1946:

Districts	Number of buying centres
Donggala	9
Toli-Toli	12
Menado	17
Sangir	5
Gorontalo	10
Parigi	7
Posso	16
Loewoek	16
Ternate	12
Ambon	7
Bali/Flores	7
S. Celebes	9
12 Establishments ..	127

Note.—In the Menado district the Copra Fund also takes up the rubber produced by a dozen estates. In the Southern Moluccas, of which Ambon is the centre, and in the Lesser Soenda Islands and Southern Celebes, the Copra Fund organization is expanding.

The interinsular traffic of the K.P.M. (Royal Packet Navigation Company) is gradually assuming pre-war proportions, and, since on January 1, 1947, it resumed control over its own ships, it has managed effectively to increase its efficiency.

A more liberal supply of workers will noticeably affect the dispatch of the sea-faring ships, which thus far were greatly delayed at Macassar. The extensive building program for the port of Macassar is approaching its completion.

In January of this year not much more than 3,000 tons of copra was exported; in February it will be in the neighbourhood of 6,000 tons.

However, the anticipated figure for the March export is 20,000 tons or even more.

Since it is expected that the production by mid-1947 will have reached 15,000 or 20,000 tons monthly, it may well be assumed that, as the accumulated supplies are gradually being shipped, the export in the coming months will maintain an average of from 15 to 20 thousand tons.

CULTIVATION OF SOYA BEANS IN THE COLONIES

BY

G. E. BLACKMAN,

Professor of Rural Economy,

University of Oxford.

Although the soya bean will grow and ripen seed from the Equator to as far north as latitude 60° (Sweden), yet at the same time the crop is peculiarly sensitive to local climatic and environmental factors. The widespread distribution has only been achieved by the careful breeding or selection of varieties to suit the conditions of each region. In the United States alone, more than 10,000 varieties have been tested and even to-day there are over a hundred varieties in cultivation to meet the different climate conditions encountered between the Canadian border and the Caribbean seaboard.

Because of this close correlation between varietal differences and local environment, it is not possible to indicate with any precision what varieties should be selected for any new area where cultivation is proposed. On the other hand there are a number of broad principles which can serve as a basis for selecting a choice of potential varieties for trial in new areas, and preliminary trial is absolutely essential before extensive cultivation is undertaken.

Firstly, the time of flowering and the yield level is conditioned by the length of day and in this respect the range of varietal differences in soya beans is from 12 to 17 hours from sunrise to sunset. *Potentially suitable varieties in any new area should therefore be selected from countries within the same latitude.* As the difference in latitude increases, so does the chance that the varieties will fail or give low yields. For example "long day" varieties suitable to northern latitudes such as Manchuria would be a complete failure in the Tropics since they would flower, set seed and ripen when only a few inches high. Conversely, sub-tropical varieties in northern latitudes will not flower at all.

Translating this length of day factor in terms of development in the Colonies, which lie largely within the Tropics, only the very short day varieties should be tested. The most intensive selection of such short day varieties in the Tropics has taken place in the Dutch East Indies and the Philippines, and the most promising varieties from these two regions should be included in any trials in the African Colonies, British Guiana, Mauritius etc.

From the tests in East Africa on soya bean varieties, selections made in South Africa at Potchefstroom appear to be the most productive. As Potchefstroom lies 27° south of the Equator, and as in America the

southernmost States lie in approximately the same latitude north of the Equator, the principal varieties grown in this region should undoubtedly be tested in both East and West Africa. The most likely American varieties are Charlie, Creole, Delnoshat, Georgian, Monetta, Nanking, Palmetto, White Biloxi and Yelredo. Many of the American varieties so far tested in central Africa are from more northern latitudes in the States.

Similarly for Cyprus, Palestine, and the Mediterranean seaboard which lies between 32° and 36°N., the most likely source of suitable varieties is again the United States. Within this latitude range potentially successful varieties should be Clemson, Delsta, Hayseed, Mamloxi, Mammoth Yellow, Mamredo and Missoy.

Apart from the question of varieties, some indication can be given of the most suitable areas within any Colony. In general soya beans will grow where maize is successfully cultivated. Soya beans can withstand short periods of drought but demand for the greatest productivity a fairly uniform moisture supply until the pods are set, when a dry period hastens ripening. Soya beans are less frost susceptible than maize but during the growing period cold nights check growth and flowering. Soya beans have the advantage too that they are tolerant of fairly acid soils, and under these conditions the oil content of the seed tends to be higher.

Soya beans, *provided* the seed is inoculated, demand a somewhat lower state of fertility than maize. All the evidence points to the importance of seed inoculation with the correct strain of soya bean nodule bacteria if maximum production is to be achieved. Hitherto in the Colonies inoculation of the seed does not seem to have been the usual practice, but in new areas it is most unlikely that the proper bacteria are present in the soil and without inoculation the results may be disappointing. Cultures of the most biologically active strains are commercially available in England.*

Finally, the tropical and sub-tropical varieties are tall types and are probably best grown in drills three to four feet apart at a seed rate of 20-50 pounds per acre according to seed size, i.e. the smaller the seed size, the lower the seed rate. Alternatively, on land liable to erosion, provided that it is relatively weed free, the seed can be broadcast but the seed rate must be 2-2.5 times the rate for drilling.

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* These strains are not necessarily the most suitable for use in Malaya.—Ed., M.A.J.

Notes and Comments.

The Resuscitation of the Malayan Pineapple Industry.

To meet the immediate needs of the pineapple industry His Excellency the Governor of the Malayan Union has appointed a committee with the following terms of reference.

"To consider the present position and prospects of the pineapple canning industry and to make specific recommendations to Government for its resuscitation."

This committee, under the chairmanship of the State Agricultural Officer, Johore, which has co-opted a representative of the Singapore Government, is now holding weekly meetings in Johore Bahru and will make specific recommendations to Government on all aspects of the industry including the establishment of new plantations, the modernisation of factory methods and the marketing of the canned product.

Coconut Experiment Station, Port Swettenham.

Arrangements are in hand for the rebuilding of a cheaply constructed Copra Kiln of advanced type as designed, pre-war, by the Chemist (Coconut Products), Department of Agriculture.

This kiln can be constructed by any person handy with tools, and experience has shown that it is capable of turning out a high grade product inside an overall time of two days. The kiln at Port Swettenham, when completed, will be used to demonstrate that heavy capital expenditure on kilns is not necessary in order to produce high grade copra.

Advisory Council, College of Agriculture.

A new Advisory Council to replace the pre-war Advisory Committee of the College of Agriculture was created in May, the membership being as follows:—

The Director of Agriculture, (Chairman).
The Director of Co-operation, Malayan Union.
The Director, Rubber Research Institute.
The Principal, Sultan Idris Training College, Tanjong Malim.
The Principal, College of Agriculture, Malaya.
The Director of Veterinary Services, Malayan Union.
The President of the United Planting Association of Malaya.
The President of the Malayan Estate Owners Association.
Che Mohd. Rashid bin Ahmad, Secretary of the Old Boys Association—College of Agriculture, Serdang.
Mr. P. A. Rogers, Kuala Lumpur.
Personal Assistant to the Director of Agriculture. (Secretary).

Review.

COCONUT RECIPES

Published by the Malayan Agri-Horticultural Association, Kuala Lumpur. Price 50 cents.

The reappearance of this booklet in its third edition, is particularly welcome at the present time, when the utilisation of locally produced foodstuffs is of paramount importance.

The products of the coconut palm are utilised in so many ways, that the palm is rightly regarded as one of the most valuable trees in tropical regions.

In the preface to the first edition it was mentioned that the booklet was published as a result of a recommendation, by the Malayan Vegetable Oils Committee in 1934, that a book containing instructions relating to the use of coconut products in domestic cookery should be prepared for publication. The compilation of more than 80 recipes, by Mrs. Marcus Dukes and others was begun and in due course the booklet was issued in connection with the Coconut Section of the Twelfth Exhibition of the Malayan Agri-Horticultural Association.

The present (1947) edition has been revised by Mr. H. L. Barnett and contains 109 recipes each of which indicates the appropriate method of incorporating some form of coconut product e.g. coconut vinegar, sugar, oil, " water ", " milk ", " cream " and " meat ", in curries, puddings, biscuits, cakes and bread, sweets, ice etc., and, for those who in recent years, have lived on a diet based on tapioca, a section is devoted to coconut-tapioca recipes which should not be ignored. Mr. F. C. Cooke has contributed an article on the coconut palm as a source of food and directs attention to the commercial possibilities of coconut honey.

The booklet is recommended as a useful aid to housewives already experienced in the use of coconut products, and as a guide to those who seek new ways of utilising local food products to the best advantage.

A. T.

VEGETABLE CULTIVATION IN HONG KONG

BY

G. A. C. HERKLOTS,

The South China Morning Post, Limited, Hong Kong.

April, 1947.

Price $12 (Hong Kong Currency).

The present book is an enlargement of the booklet written by Dr. Herklots in 1941. Whereas the earlier edition contained 86 pages and 38 line drawings, the present book consists of 196 pages and 86 line drawings.

The second edition was largely written whilst the author was interned in the Civilian Internment Camp at Stanley during the Japanese occupation of Hong Kong. In a brief introduction Dr. Herklots describes some of the difficulties experienced and makeshifts undertaken in order to win through in the production of vegetables in the Camp. Those of us who were similarly occupied during internment under the Japanese in Malaya have recollections of similar experiences.

The preliminary chapters describe what a gardener wants to know. The first is the Principles of Gardening which forms an excellent guide to an amateur. The section dealing with the number of light hours that influence plants is interesting and reference is made to those few vegetables which are affected by the length of daylight. Chapters on the Physical, Chemical, and Biological Properties of the Soil, Essential Elements and Fertilizers follow. The information provided is clear and supplies a general outline on the various treatments of garden soils and the use of inorganic fertilizers and organic manures.

The chapter on the Food Values of Vegetables is comprehensive and explains the human requirements of the three groups of foods, i.e. carbohydrates, fats, and proteins, and the foodstuffs to be consumed in order to supply any possible vitamin deficiencies.

Pests and their control is an interesting chapter and describes the pests and diseases encountered and suggested treatments. The lack of authority for the various recommendations suggests that more work remains to be done in this field. A short summary of the known information regarding the two new insecticides commonly known as DDT and Gammexane serves as a reminder of the possibilities of these chemicals and indicates the desirability of extended trials.

A chapter is devoted to the weeds that are troublesome in Hong Kong gardens; and to the use of sodium chlorate, and compounds that are employed in certain proprietary weed killers that may be used to control weeds.

A number of plants, that may be used as hedges in Hong Kong where much wind is experienced and wind breaks are often a necessity, are listed and described.

Dr. Herklots mentions a number of gardening books that deal with vegetables suitable for cultivation in the East and other aspects of vegetable production including the control of insect pests. It is interesting to learn that an Agricultural Department has been formed in the Colony and thus many of the problems confronting the gardener may now be investigated more fully.

These chapters take about a third of the book and the remainder deals with descriptions and cultural recommendations of the large number of vegetables that it is possible to grow in Hong Kong during certain months of the year. The line drawings prepared by the author, of which the majority were drawn during internment, are excellent and add interest and clarity to the descriptive matter. The vegetables described are given their English and Chinese names together with the respective botanical name and family. Where pests and diseases are troublesome, these are mentioned and recommendations made for their control. In many instances useful notes are added providing information regarding food values and special cultural requirements that are recorded as a result of personal observations.

It is not possible to refer to the numerous vegetables described in detail in this review. The book is of particular value to those who require authoritative information regarding the many vegetables which are known from South China. The accounts of the Chinese cabbages and allies are helpful and will enable many difficulties in the identification of these leaf vegetables to be settled. It is evident that further investigations are necessary regarding the identification of the Chinese onions, two of which are rarely grown from seed, but propagated by division of the bulbs. One of these onions was extensively grown, in Singapore, in Sime Road Civilian Internment Camp, where its cultivation and production reached a high standard.

The small section dealing with Market Vegetables is useful, and includes those crops not normally cultivated in home gardens but which are grown by market gardeners for sale and export. Several of these garden crops find their way to the shops and markets in Malaya at certain seasons of the year.

Finally, a number of vegetable recipes are included along with a full index, including Romanised Chinese names for the vegetables described.

" Vegetable Cultivation in Hong Kong " is a valuable post-war book for the gardener and Dr. Herklots is to be congratulated on its publication at a time when previous publications on the subject have been lost and are difficult to replace.

J. N. M.

Departmental.

FROM THE DISTRICTS

Compiled by the Chief Field Officer from Monthly Reports of Agricultural Officers.

March, April and May, 1947.

The Weather.

Rainfall during March was generally above average in most districts, with abnormally wet weather in most of the Western States. The North East monsoon was heavy and sustained on the East Coast, with mild flooding of the Kelantan River causing damage to food crops. Drier weather occurred in April, especially during the latter part of the month. In South Johore, however, the weather was wet throughout the month. Severe storms in parts of Selangor caused flooding. The weather was hot and dry on the East Coast during May. Wet weather was experienced in most of the Western States, with abnormally high rainfall in several districts.

Crop Reports.

Foodcrops and Vegetables.—A substantial increase in the acreage under foodcrops was reported from Malacca for the first quarter of the year. Compared with the last quarter of 1946, it is estimated that a further 3,762 acres have been planted. Fallow season cultivation of padi land is estimated to be well over 1,000 acres and very large consignments of miscellaneous vegetables and root crops were exported mostly to Singapore and Kuala Lumpur. An association of Chinese gardeners under the name of the Chinese Food Cultivators Association was formed in March, with close liaison with the Department of Agriculture. It is hoped that the members will reap the benefits of bulk purchase and co-operative marketing.

The weather experienced in Johore South during March was favourable to the cultivation and production of foodcrops and vegetables, and approximately 10,942 piculs of various vegetables and fruits were exported to Singapore.

There was increased activity in the cultivation of tapioca in the Tanjong Rambutan and Chemor Districts of Perak during May, and 4,026 piculs of tapioca flour and 1,055 piculs of tapioca pearl were exported to Singapore during the month. Large areas were maintained under sweet potatoes and groundnuts throughout the Kinta District, where sweet potatoes were sold wholesale at $6 per picul.

In Selangor, the cultivation of bitter cucumber (peria) is expanding in two areas, one on the Cheras Road and the other on the Puchong Road. This crop is grown under a system of continuous trellises. A special study is being made of this crop.

The output of vegetables at Cameron Highlands during the month of May continued steady with the anticipated seasonal rise in price from the low levels reached in April. At the end of the month cabbage was sold at $22 per picul to growers compared with $10-$14 during April. Prices of first-grade prawn dust fell to $16 per picul.

Good progress was made during March in Penang in the purchase of lime and groundnuts for free distribution to growers for use in padi fields. A total of sixty acres is expected to be planted with seed supplied by the Department. About 200 acres of off-season crops, mostly groundnuts and sweet potatoes were planted on padi land on the east side of Penang Island.

Wet Padi.—In the Tanjong Karang padi area of Selangor, the agreed average yields of padi per acre for the past season for three districts are as follows:—Sawah Sempadan 300 gantangs; Sungei Burong 250 gantangs; Sekinchang 250 gantangs.

The area planted with off-season Taiwan padi in Province Wellesley Central and North was 1,567 acres. Weather conditions were ideal to start with, but later a spell of dry weather hampered growth.

At Sungei Manik, Lower Perak, uneven ripening has necessitated harvesting by 'tuai' instead of the much more rapid 'sabit'. The crop in the older areas was quite good and 25,400 piculs of padi was purchased by the Government Rice Mill, Telok Anson, up to the end of May.

It is estimated that well over 1,000 acres of off-season padi have been planted in the inland districts of Pahang this season, of which over 600 acres are accounted for in Bentong District. Many areas were in flower during May and the crops generally were promising. It was noted that some Malays in areas adjacent to those cultivated by Chinese, were following the example of the latter in taking two crops of padi during the year.

In order to encourage the use of the plough in North Johore, a ploughing demonstration was given to interested padi planters in several mukims. At Jementah, the padi planters carried out work in the padi fields co-operatively, working in groups of six to ten persons.

The report from Kedah for May states that good progress was made in ploughing, and abandoned padi land is being brought into cultivation. Influenced by the guaranteed price a large increase in the area under padi is anticipated during the coming season.

In the Jelebu District of Negri Sembilan, considerably increased planting has been undertaken and it is estimated that there will be an increase of about 1,100 acres of padi land this season. This includes about 370 acres of new padi areas in Durian Gasing and Triang Ilir, the balance being land that was not cultivated last season. This is a substantial increase from 2,600 to 3,700 acres. In other districts, where the season is later than Jelebu good progress is being made, and a substantial increase in acreage can be confidently anticipated.

Rubber.—The heavy fall in prices has caused considerable gloom among small-holders. In Negri Sembilan, the price of No. 1 smoked sheet fell

from $52.50 per picul at the beginning of May to $35 at the end of the month.

In Johore Central, the price trend was downward with a sharp drop early in May, the fall averaging $15 per picul for both smoked and unsmoked sheet. Prices per picul for the period April-May for the three grades were as follows: smoked sheet, April $50 to $52, May $34 to $38; unsmoked sheet, April $43 to $47, May $30 to $33; scrap, April $20 to $24, May $15 to $18.

As a result of the fall in prices, almost all small and medium holdings where tappers were previously employed have ceased tapping in Province Wellesley, the tappers having to find other employment. Tapping was continued on holdings where the small holder does his own tapping.

Coconuts.—There was an all-round increase in the price of coconuts and copra in Johore. Prices for coconuts rose to $70 per 1,000 and copra $18 to $20 per picul.

Miscellaneous crops.—Some 70 acres of tobacco is under cultivation in the Baling District of Kedah, first quality leaf being sold at $140 to $150 per picul.

The planting of patchouli is still proceeding in the Jerantut District of Pahang, the estimated planted acreage being 80 acres. Chinese cultivators in Johore Central are showing interest in patchouli as a catch crop with gambier and have commenced felling jungle with the intention of planting 300 acres.

Poultry.

Poultry raising is reported to be becoming more evident throughout the villages. Duck farming is generally receiving more attention from the Chinese. Four farms in the vicinity of Malacca town have a daily output of 60 to 80 eggs from approximately 110 layers. The ration fed consists of a mixture of rice bran, tapioca refuse, copra cake and fish refuse.

The Veterinary Department carried out vaccination trials against Ranikhet disease (diptheritic stomato-pharyngitis) of poultry both at Agricultural Stations and in the villages. The effects of vaccination on the poultry at the Agricultural Station, Cameron Highlands, was rather drastic and a number of birds died. In May the flock appeared to have recovered. Elsewhere the effects of vaccination was less severe.

Miscellaneous.

Bat Guano Distribution.—The distribution of bat guano to padi planters in Kedah and Perlis for manuring their padi lands was organized by the State Agricultural Officer; during May a total of 1,470,340 gantangs was distributed. Arrangements for the distribution of bat guano from Perlis caves was also made in Province Wellesley and Kelantan.

Buffaloes.—A sum of $60,000 was provided by Government for the purchase of buffaloes from Trengganu for use of padi planters in the Pekan District of Pahang. The money is to be disbursed in the form of recoverable loans and representatives of the intending purchasers proceeded to Trengganu to do the buying themselves. The present scheme allows for the

purchase of some 200 buffaloes but applications have been received from the remaining five districts of Pahang for loan funds to cover the purchase of an additional 600 animals. Successful ploughing demonstrations were held in several parts of Raub District during May, thus reviving the pre-war efforts to replace the changkol by the plough and harrow in suitable areas of Pahang. It is virtually a restart as the great majority of the trained animals were lost during the Japanese occupation.

Destruction of Animal Pests.—All States report good results in the campaign against wild pigs, rats and, in some districts, squirrels. Wild pigs were destroyed by hunting, shooting, trapping and poisoning, and very large numbers were killed. Shortage of 12-bore ammunition became acute in almost all States and with more ammunition available it will be possible to reduce the damage to food crops by wild pigs to more reasonable limits.

DEPARTMENTAL NOTES

Bestowal of Honour.

His Majesty the King has been graciously pleased to approve the bestowal of the Honour—Honorary Companion of the Most Distinguished Order of St. Michael and St. George on His Highness Tunku Yaacob bin Sultan Abdul Hamid, State Agricultural Officer, Kedah and Perlis.

The Staff of the Department convey their congratulations to Tunku Yaacob on the well merited recognition of his services to Malaya in general, and especially to the State of Kedah, in which State he has rendered excellent services to Agriculture and stimulated rural industries by example and precept.

Retirement of Mr. Saravanamuthu.

Mr. Saravanamuthu the well known Gardens Assistant will retire from Government Service on 14.7.47. He has, since 1917, been responsible, often with the minimum of supervision by Senior Officers, for the maintenance of the Public Gardens, Kuala Lumpur, the Grounds of King's House and the Lodge of His Highness the Sultan of Perak, those of the Chief Secretary and the Residency, and, since the re-occupation, the grounds of the Resident Commissioner.

The excellent condition of the Public Gardens, up to December 1941, was not only a testimonial to his industriousness and abilities as a horticulturist but a tribute to his aptitude in the handling of labour.

This Officer was always ready to assist the residents of Kuala Lumpur and its environs in the planning, lay out, and replanting of compounds; his most extensive knowledge of tropical horticulture made his advice most valuable, and it was always tendered in a pleasant and courteous manner.

Mr. Saravanamuthu will be missed by his many friends, and his retirement from the Service will be a great loss to the Department and the general public.

The Director and Staff of the Department hope that he will enjoy his pension and rest from his labours for many years to come.

College of Agriculture, Malaya.
Opening Ceremony - 3rd. June, 1947.

The first new classes of students to be admitted to the College of Agriculture at Serdang since 1941 were enrolled on the 2nd June, 1947, and the College was declared to be open by H.E. Sir Edward Gent, Governor of the Malayan Union, at a ceremony held on the following day.

The numerous and distinguished guests were received by Mr. F. Burnett, the Director of Agriculture and Chairman of the College's new Advisory Council and Mr. V. Dawson, the Principal. Following the presentation of staff and students, to His Excellency the Governor and His Highness the Sultan of Selangor, a group photograph was taken of all present at the ceremony. The party then repaired to the College Hostel where the various addresses were delivered.

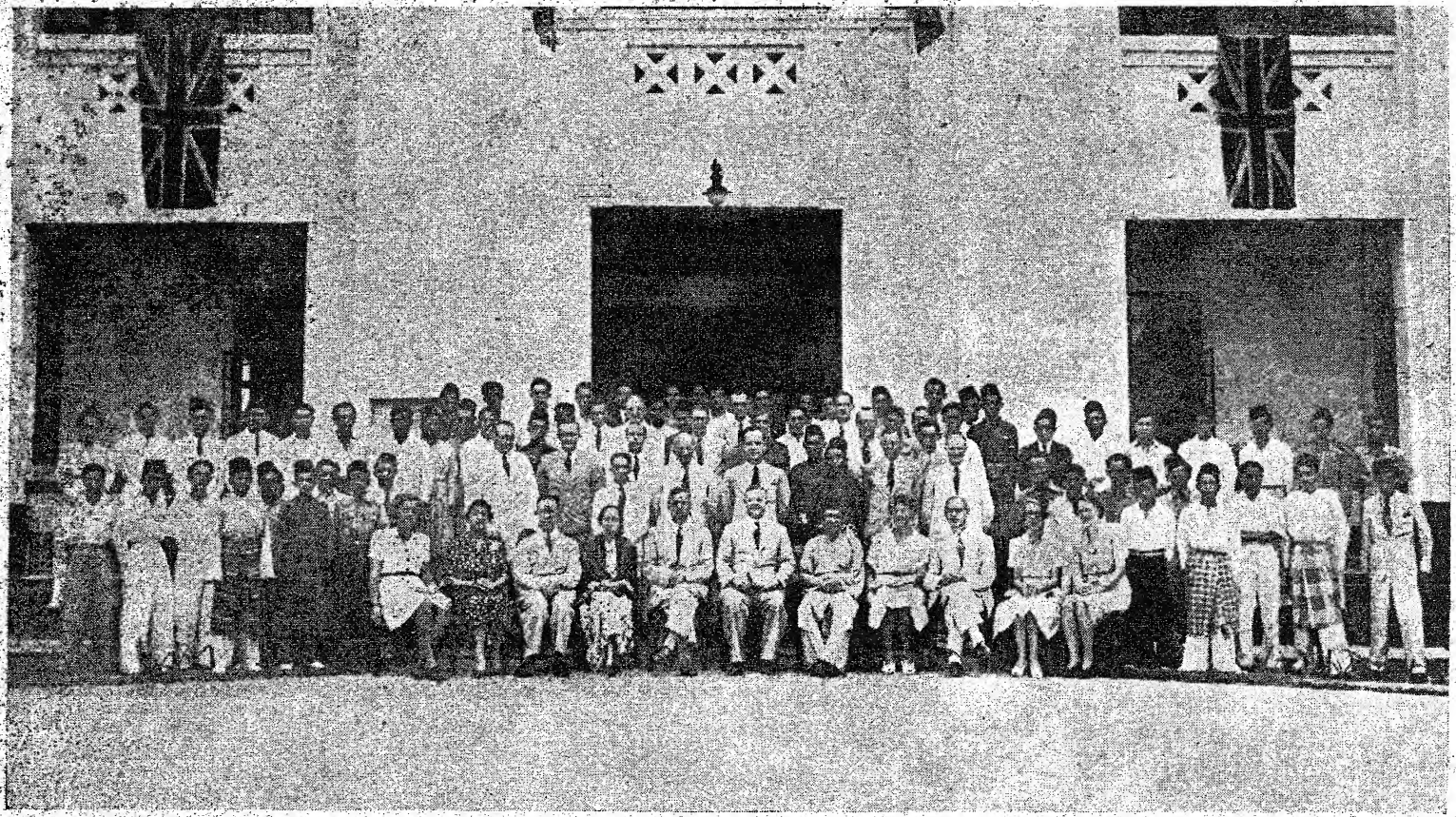
College of Agriculture.

H.E. The Governor, Speaking at the Opening Ceremony.

Photo by courtesy of
The Department of Public Relations

Following upon Mr. Burnett's address of welcome to the guests and the progress report delivered by the Principal, His Excellency rose to make an historic declaration. After emphasizing the importance of agricultural education in Malaya and in the nearby territories of Borneo, Sarawak and Brunei, Sir Edward said: " Alongside the broad acres of the Research Institution and its testing grounds, the School is well placed for higher education as a residential college. Let us show our resolution by calling this Institution the College of Agriculture, and thus pledge ourselves to it's growth as the academy for the higher scientific training of students in agriculture, who will serve and save this country's land that no man may damage it, though he may use it well to produce the crops which the country and the world may need." With these words the School of Agriculture, Malaya, which first opened in 1931, was formally declared to be a College.

His Highness the Sultan of Selangor addressed the gathering in Malay. He too stressed the importance of local agriculture and impressed upon the students the importance of the practical aspects of their studies. He pointed out that labour has its own dignity and that theory and practice must go hand in hand if the students were to derive the maximum of benefit from their training at the College.



Group taken at the opening ceremony, College of Agriculture, 3rd June, 1947.

Photo by courtesy of
The Department of Public Relations.

The Honourable Mr. S. B. Palmer, on behalf of the Advisory Council, staff and students, thanked the guests for their speeches and for their kindness in attending the ceremony, which was concluded by an inspection of the buildings and the partaking of light refreshments served in the Library.

Appointments, Promotions and Transfers

The Right Honourable the Secretary of State for the Colonies has been pleased to approve the promotion of Mr. V. Dawson, Vice Principal, School of Agriculture, Malaya, to be Principal, School of Agriculture, Malaya, with effect from 24th July, 1946, inclusive.

Mr. A. Thompson, Senior Plant Pathologist, has been appointed to act as Agricultural Economist and Editor, Department of Agriculture, and to act as Registrar of Statistics, Malayan Union in addition, with effect from 23rd April, 1947.

Mr. A. Johnston, Plant Pathologist, has been appointed to act as Senior Plant Pathologist with effect from 23rd April, 1947.

His Excellency the Governor has been pleased to approve the appointment of Mr. Herbert Frederick Logan to be Personal Assistant to the Chief Field Officer, Department of Agriculture, Malayan Union, with effect from 8th April, 1947.

Mr. C. E. Courtenay assumed duty in the post of Adviser, Malayan Pineapple Industry, on first appointment with effect from 9th February, 1947 and is stationed at Johore Bahru.

Mr. T. D. Marsh, Senior Agriculturist Research, was transferred to Headquarters as Field Advisory Officer to the Chief Research Officer with effect from 1st May, 1947.

Mr. H. J. Simpson, Agriculturist, assumed executive and administrative control of the Central Experiment Station, Serdang, with effect from 1st May, 1947.

Mr. G. Griffith, Chemist (Soils), Department of Agriculture, Malayan Union, has been selected by the Right Honourable the Secretary of State for the Colonies for transfer, in the Colonial Agricultural Service, as Senior Chemist, Department of Agriculture, Uganda. Mr. Griffith sailed from England for Uganda on the 2nd April, 1947.

Dr. S. G. Willimot, has been seconded to the Department of Agriculture from the Department of Chemistry and took up the duties of Chemist (Soils) as from 19th May, 1947.

Mr. G. S. Keeping, Agricultural Officer, went on transfer from Headquarters to Central Experiment Station, Serdang, on 15th April, 1947.

Mr. H. M. James, arrived at Headquarters on 21st April, 1947, on transfer from Central Experiment Station, Serdang, to act as Personal Assistant to Director of Agriculture.

Dr. A. E. S. McIntosh, Acting Deputy Director of Agriculture, acted as Director of Agriculture, from 15th March, 1947 to 14th April, 1947 and

assumed duty as Acting Deputy Director of Agriculture with effect from 15th April, 1947.

Mr. J. R. Curry, State Agricultural Officer, Negri Sembilan, has been appointed State Agricultural Officer, Pahang, with effect from 18th June, 1947.

Mr. D. G. Jones, Agricultural Officer, has been appointed State Agricultural Officer, Negri Sembilan, with effect from 21st June, 1947.

Mr. J. L. Greig, State Agricultural Officer, Kelantan, has been appointed to act as State Agricultural Officer, Trengganu, in addition, with effect from 5th May, 1947.

Mr. J. Cook, Agricultural Officer, Malacca, has been appointed to act as Agricultural Officer, Johore North, in addition, with effect from 24th May, 1947.

Inche Zakaria bin Abdul Raof has been appointed to officiate as Malay Agricultural Officer, Selangor Coast, Klang, with effect from 1st January, 1947.

Inche Kamardin bin Bahar has been appointed Malay Research Officer, Research Branch, Department of Agriculture, with effect from 10th December, 1946.

Inche Jaaffar bin Mampak has been appointed to officiate as Malay Agricultural Officer, Kelantan, with effect from 1st January, 1947.

Inche Mohd. Ramly bin Haji Tahir has been appointed to officiate as Malay Agricultural Officer, Perak Central, with effect from 1st January, 1947.

Raja Mahmud bin Raja Ali has been transferred to Pahang East as Malay Agricultural Officer with effect from 18th June, 1947.

Leave.

Mr. H. L. Barnett, Acting Agricultural Economist, Department of Agriculture, Malayan Union, has been granted 180 days leave on full pay in addition to voyage leave with effect from 24th April, 1947.

Mr. H. K. Ashby, State Agricultural Officer, Trengganu, has been granted 180 days leave with effect from 14th May, 1947.

Mr. H. D. Meads, Personal Assistant to Director of Agriculture, has been granted 192 days leave with effect from 2nd June, 1947.

Mr. R. G. Heath, State Agricultural Officer, Pahang has been granted 120 days leave with effect from 22nd June, 1947.

Mr. B. G. A. Lowe, Agricultural Officer, Cameron Highlands, returned from leave on 15th April, 1947.

Statistical.

MARKET PRICES.

June 1947.

Rubber.—In the first half of April the Singapore price of rubber dropped from 44 to 43 cents per lb. and the month ended with the price at 43⅛ cents per lb. In the first three weeks of May the price dropped from 43⅛ to 29¼ cents per lb. The rubber price advanced in the first week of June to 33⅝ cents but by 25th June had fallen back to 24⅛ cents per lb. easing to close at 25⅞ cents per lb.

The average prices paid for small-holders' rubber at three centres during the second quarter of 1947 are given in Table I.

Table I.

Average Weekly Prices Paid by Local Dealers for Small-Holders' Rubber, April-June, 1947.

(Dollars per picul of 133⅓ lbs.)

Grades	Ipoh, Perak.			Kuala Pilah, Negri Sembilan.			Batu Pahat, Johore.		
	Apr.	May	June	Apr.	May	June*	Apr.	May	June
Smoked Sheet ..	50.63	39.75	32.60	51.42	37.88	32.13	51.27	43.63	33.91
Unsmoked Sheet ..	43.25	31.25	27.00	45.08	31.62	24.63	42.95	36.68	28.16
Scrap ..	17.75	13.50	10.00	21.17	11.50	9.50	23.96	16.44	12.54

Transport from Batu Pahat to Singapore by lorry, excluding duty, $1.00 per picul.
* Average of prices for last two weeks of June only.

Table II.

Singapore Prices of Various Agricultural Products.

Product	June, 1947			May 1947
	Highest	Lowest	Average	Average
	per picul $	per picul $	per picul $	per picul $
Copra:				
Sundried No. 1 ..	24.00	18.50	19.75	21.75
No. 2 ..	*	*	*	*
No. 3 ..	*	*	*	*
Coconut Oil ..	40.00	36.00	37.00	34.75
Coffee:				
Padang Bali No. 1 ..	170.00	92.00	106.75	158.00
No. 2 ..	152.00	80.00	96.50	140.50
Palembang No. 1 ..	80.00	54.00	64.75	72.00
Sourabaya New No. 1	90.00	67.00	77.75	86.00
Bali Old ..	*	*	*	*
Pepper:				
Muntok White ..	115.00	98.00	111.75	97.00
Lombong White ..	109.00	91.00	103.75	87.00
Sibu White ..	*	*	*	*
New Black ..	*	*	*	*
Old ..	*	*	*	*
Sarawak ..	113.00	96.00	107.50	92.00
Siam Black ..	75.00†	63.00†	68.25†	65.00
Nutmeg:				
No. 1 ..	*	*	*	*
No. 2 ..	*	*	*	*
Cloves:				
Indian ..	45.00	41.00	43.00	41.00
Sumatra ..	55.00	55.00	55.00	55.00
Gambier:				
Cube No. 1 ..	*	*	*	*
No. 2 ..	*	*	*	*
Cake ..	*	*	*	*
Sago Flour:	18.00	13.50	14.00	15.00
Lingga ..	*	*	*	*
Local No. 1 ..	*	*	*	*
No. 2 ..				
Tapioca Flour:				
Malayan No. 1 ..	30.00	24.00	24.00	26.90
No. 2 ..	24.00	21.00	21.00	23.00
Java ..	*	*	*	*

* Not quoted.
† Quoted for first 11 days of June only.

MALAYAN UNION PRODUCTION OF PALM OIL AND KERNELS.

(In long tons as declared by Estates)

Month 1947	Palm Oil	Palm Kernels
January	2,238.2	292.3
February	2,316.9	337.1
March	2,585.8	386.2
April	2,410.2	380.2
May	2,377.7	359.9
Total ..	11,928.8	1,755.7
Total May-December, 1946 ..	11,756.4	931.6 (Aug.-Dec.)
Total Jan.-Sept., 1941 ..	38,588.4	2,332.5
Total for the year 1940 ..	57,972.1	9,611.2

Stocks on estates as at 31st May, 1947, were: palm oil 1,050 tons, palm kernels 463 tons.

In February 33 estates (planted acreage 70,816.4 acres) were in production out of a total of 46 oil palm estates (planted acreage 77,969.4 acres).

MALAYAN AGRICULTURAL EXPORTS, JANUARY, 1947.

Product	Net Exports in Tons.		
	Year 1940	Jan.-Oct. 1941	January 1947
Arecanuts	43,915	24,633	1,061
Coconuts fresh†	131,469†	178,404†	1,052†
Coconut oil	69,446	65,045	3,051
Copra	9,004*	32,682*	2,529*
Copra cake	1,215*	5,659*	282*
Gambier, all kinds ..	821	489	51
Palm kernels	9,219	1,984	210
Palm Oil	56,091	44,406	1,772
Pineapples, canned ..	40,243	15,086	320
Rubber¶	547,202¶§	500,982¶§	52,570¶
Sago,—flour	2,525	1,752*	982*
„ —pearl	4,848	6,217	24*
„ —raw	4,816*	4,400*	897*
Tapioca,—flake ..	762	601	20
„ —flour ..	2,649*	4,310*	242
„ —pearl ..	17,004	15,164	—
Derris	1,258	998	1,028

† hundreds in number. * net imports. ¶ production.
§ Malayan Union and Singapore.

MALAYAN UNION RUBBER STATISTICS.

Estates of 100 Acres and over. Production May, 1947.

In Dry Tons.

STATE	PRODUCTION						STOCKS		PREPARED LATEX PRODUCTION	
	European	Chinese	Indian	Others	Total	Total Jan./May 1947	Beginning of *Month*	End of *Month*		
(1)	(2)	(3)	(4)	(5)	(6)	(7)				
Perak ..	3,892	385	215	23	4,515	22,484	3,577	4,048	Preserved field Latex	682
Selangor ..	4,432	369	87	7	4,895	23,783	3,852	4,778		
N. Sembilan ..	3,638	288	125	94	4,145	19,329	2,544	3,097	Centrifuge Concentrate	1,147
Pahang ..	1,235	779	126	—	2,140	8,734	1,256	1,628		
Malacca ..	1,101	352	78	—	1,531	7,728	1,052	1,283		
Penang & P. Wellesley	319	65	3	—	387	1,791	261	393	Revertex	134
Johore ..	5,555	923	230	563	7,271	30,765	4,225	5,525		
Kedah ..	3,003	386	112	26	3,527	17,170	2,304	2,673		
Perlis ..	—	3	16	—	19	108	17	16		
Kelantan ..	418	65	—	20	503	1,882	364	495		
Trengganu ..	122	66	—	6	194	660	128	154		
Total ..	23,715	3,681	992	739	29,127	134,434	19,580	24,090		1,963

Notes:—1. Figures for production of prepared latex for export are included in the month's production figures, columns 2 to 6.

2. Production by estates of less than 100 acres for May, 1947, was estimated to be 18,009 tons. Total estimated smallholding production January to May, 1947, 123,680 tons.

3. Total latex production 1946, 5,223 tons. Latex production April, 1947, field latex 519 tons, centrifuge 1,004 tons revertex 108 tons.

4. Stocks on estates of less than 100 acres are not ascertained.

5. The above forms part of the May rubber statistics published by the Acting Registrar of Statistics, Malayan Union, at Kuala Lumpur, on 21st June, 1947.

MALAYAN UNION RUBBER STATISTICS.

Acreages of Tappable Rubber Actually Tapped and not Tapped on Estates of 100 Acres and over for the Month ending 31st May, 1947.

STATE	Estimated Acreages of Tappable Rubber (9) + (11)	Acreage of tappable Rubber not tapped: On estates which have entirely ceased tapping		On estates which have partly ceased tapping (a)		Area of tappable rubber never been tapped (b)		Total Area not tapped (3) + (5) (c)		Total Area tapped during the month (c)		Area of tappable rubber rested under rotational systems (c)	
		Acreage	% of (3) to (2)	Acreage	% of (5) to (2)	Acreage	% of (7) to (2)	Acreage	% of (9) to (2)	Acreage	% of (11) to (2)	Acreage	% of (13) to (2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Perak ..	272,179	1,690	.6	46,298	17.0	11,784	4.3	47,988	17.6	224,191	82.4	21,849	8.0
Selangor ..	319,451	1,317	.4	49,218	15.4	16,841	5.3	50,535	15.8	268,916	84.2	14,079	4.4
N. Sembilan ..	255,434	3,670	1.5	67,743	26.5	22,033	8.6	71,413	28.0	184,021	72.0	12,229	4.8
Pahang ..	91,840	452	.5	16,879	18.4	8,068	8.8	17,331	18.9	74,509	81.1	4,048	4.4
Penang & P. Wellesley ..	27,089	1,341	4.9	2,874	10.6	971	3.6	4,215	15.6	22,874	84.4	5,803	21.4
Malacca ..	120,163	2,394	2.0	15,968	13.3	4,610	3.8	18,362	15.3	101,801	84.7	8,511	7.1
Johore (d) ..	447,474	9,598	2.2	111,081	24.8	37,055	8.3	120,679	27.0	326,795	73.0	25,887	5.8
Kedah ..	188,704	655	.4	31,953	16.9	13,639	7.2	32,608	17.3	156,096	82.7	23,222	12.3
Kelantan ..	30,044	215	.7	11,981	39.9	2,693	9.0	12,196	40.6	17,848	59.4	291	1.0
Trengganu ..	15,488	350	2.3	6,003	38.7	826	5.3	6,353	41.0	9,135	59.0	1,086	7.1
Perlis ..	1,710	—	—	415	24.3	197	11.5	415	24.3	1,295	75.7	240	14.0
Total ..	1,769,576	21,682	1.2	360,413	20.4	118,717	6.7	382,095	21.6	1,387,481	78.4	117,245	6.6

Notes:—(a) Area out-of-tapping on estates which have partly ceased tapping refers to areas definitely being rested and excludes area on any tapping round.

(b) The acreage shown in column (7) is included in columns (3) and (5).

(c) Areas of tappable rubber rested under rotational systems are not considered as out-of-tapping and therefore columns (11) and (12) include columns (13) and (14) respectively.

(d) Registered estates only.

(e) This table was published by the Acting Registrar of Statistics, Malayan Union, on 24th June, 1947.

MALAYAN UNION RUBBER STATISTICS.

Summary of Stocks, Production, Imports and Exports of Rubber, May, 1947.

In Long Tons, Dry Weight.

		Tons	Tons
STOCKS (30th April)			
Estates	..	19,580	
Dealers	..	66,591	
Ports, awaiting shipment	..	11,470	97,641
IMPORTS	..		4,877
PRODUCTION			
Estates	..	29,127	
Small-holdings (estimated)	..	18,009	47,136
Total	..		149,654

		Tons	Tons
EXPORTS			
Foreign	..	44,767	
Local (to Singapore)	..	20,041	64,808
LOCAL CONSUMPTION	..		212
STOCKS (31st May)			
Estates	..	24,090	
Dealers	..	49,837	
Ports, awaiting shipment	..	10,707	84,634
Total	..		149,654

Note:—The above forms part of the May rubber statistics published by the Acting Registrar of Statistics, Malayan Union, at Kuala Lumpur, on 21st June, 1947.

MALAYAN UNION PADI STATISTICS.

PADI SEASON 1946—1947.

Acreages of Wet Padi harvested monthly and Estimated Yields.

STATE	Total Planted area Acres	Total to 30th April, 1947			May, 1947			Total to 31st May, 1947		
		Area Harvested Acres	Per cent (3) to (2)	Estimated Average Yield per acre (Gtgs.)	Area Harvested Acres	Per cent (6) to (2)	Estimated Average Yield per acre (Gtgs.)	Area Harvested Acres	Per cent (9) to (2)	Estimated Average Yield per acre (Gtgs.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Perlis ..	36,640	36,640	100.0	281	—	—	—	36,640	100.0	281
Kedah ..	236,820	236,820	100.0	260	—	—	—	236,820	100.0	260
Kelantan ..	132,814	113,270	85.3	164	12,271	9.2	82	125,541	94.5	156
Trengganu ..	34,876	25,155	72.1	167	9,721	27.9	148	34,876	100.0	161
Penang & P. Wellesley ..	36,881	34,492	93.5	233	1,000	2.7	50	35,492	96.2	228
Perak ..	106,491	96,345	90.5	167	9,796	9.2	177	106,141	99.7	168
Selangor ..	34,113	18,831	55.2	301	7,000	20.5	325	25,831	75.7	307
Pahang ..	39,667	38,749	97.7	184	885	2.2	142	39,634	99.9	183
Negri Sembilan ..	29,612	29,602	99.9	196	10	.1	30	29,612	100.0	196
Malacca ..	30,611	30,611	100.0	186	—	—	—	30,611	100.0	186
Johore ..	12,835	12,835	100.0	124	—	—	—	12,835	100.0	124
Total ..	731,360	673,350	92.0	215	40,683	5.6	163	714,033	97.6	212

Notes:—1. Compiled by the Acting Registrar of Statistics, Malayan Union, from returns received through the Field Branch of the Department of Agriculture.

2. Acreages are amended according to the latest returns received. The latest return is, therefore, the most reliable.

MALAYAN UNION

PADI SEASON 1946—1947.

Acreages of Dry Padi harvested monthly and Estimated Yields.

STATE	Total Planted area Acres	Total to 30th April, 1947			May, 1947			Total to 31st May, 1947		
		Area Harvested Acres	Per cent (3) to (2)	Estimated Average Yield per acre (Gtgs.)	Area Harvested Acres	Per cent (6) to (2)	Estimated Average Yield per acre (Gtgs.)	Area Harvested Acres	Per cent (9) to (2)	Estimated Average Yield per acre (Gtgs.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Perlis ..	60	60	100.0	103	—	—	—	60	100.0	103
Kedah ..	4,255	4,255	100.0	87	—	—	—	4,255	100.0	87
Kelantan ..	32,493	32,493	100.0	96	—	—	—	32,493	100.0	96
Trengganu ..	18,182	17,978	98.9	137	204	1.1	70	18,182	100.0	131
Penang & P. Wellesley	840	109	13.0	151	—	—	—	109	13.0	151
Perak ..	15,041	15,041	100.0	86	—	—	—	15,041	100.0	86
Selangor ..	5,802	5,802	100.0	91	—	—	—	5,802	100.0	91
Pahang ..	4,409	4,195	95.1	88	214	4.9	65	4,409	100.0	86
N. Sembilan ..	36	36	100.0	29	—	—	—	36	100.0	29
Malacca ..	120	120	100.0	198	—	—	—	120	100.0	198
Johore ..	3,052	2,479	81.2	66	Return not received			2,479	81.2	66
Total ..	84,290	82,568	98.0	101	418	.5	67	82,986	98.5	101

Notes:—1. Compiled by the Acting Registrar of Statistics, Malayan Union, from returns received through the Field Branch of the Department of Agriculture.

2. Acreages are amended according to the latest returns received. The latest return is, therefore, the most reliable.

METEOROLOGICAL SUMMARY, MALAYA, APRIL, 1947.

Locality.	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day.	Number of days					Total	Daily Mean	Per cent.
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F			Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
										ins.	m.m.	ins.								
Ipoh, Perak ..	93.4	73.8	83.6	97	72	87	77			11.91	302.5	2.60	23	19	11					
Port Swettenham, Selangor	90.3	74.2	82.3	93	72	86	76	85.7	85.0	8.74	222.0	1.65	19	15	1	1				
Sitiawan, Perak ..	89.0	74.3	81.7	91	73	84	76			10.16	258.1	2.44	17	13	1	2				
Kuala Lipis, Pahang ..	89.8	73.4	81.6	93	71	78	76	84.9		21.31	541.3	3.91	21	21	1	27				
Kuantan, Pahang ..	88.2	73.9	81.1	91	72	83	77			13.75	349.3	3.96	18	18	1	3				
Bayan Lepas, Penang ..	87.7	75.3	81.5	91	73	85	77			12.37	314.2	2.40	16	14	4					
Malacca ..	85.8	75.0	80.4	89	72	83	77			5.84	148.3	2.42	17	11						
Mersing, Johore ..	86.3	73.3	79.8	92	71	78	75			8.14	206.8	1.86	21	17	3					
Alor Star, Kedah ..	89.9	74.5	82.2	93	72	84	77			7.16	181.9	3.35	17	15	3	2				
K. Trengganu, Trengganu	88.5	74.4	81.5	91	72	83	77			9.87	250.7	3.09	17	12	3	1				
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. ..	73.8	63.0	68.4	78	61	68	64	71.9		16.33	414.8	2.47	26	25	2	10				
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	74.2	58.7	66.5	80	54	69	62	70.9		13.45	341.6	2.28	26	21	1	3				

Compiled from Returns supplied by the Meteorological Branch, Malaya.

METEOROLOGICAL SUMMARY, MALAYA, MAY, 1947.

Locality.	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes									Number of days							
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total		Most in a day. Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
										ins.	m.m.	ins.								
Ipoh, Perak ..	91.9	73.8	82.9	96	72	89	77			19.54	496.3	3.99	25	22	4					
Port Swettenham, Selangor	89.5	74.3	81.9	93	71	85	76	85.0	85.2	8.98	228.1	1.26	23	22	3	1				
Sitiawan, Perak ..	89.1	74.5	81.8	91	72	86	78			7.04	178.8	1.66	19	16	5	3				
Kuala Lipis, Pahang ..	91.0	73.5	82.3	93	71	85	76	84.3		7.58	192.5	1.53	19	15	2	24				
Kuantan, Pahang ..	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
Bayan Lepas, Penang ..	87.1	75.6	81.3	89	74	81	78			14.15	359.4	2.95	20	17	6					
Malacca ..	86.5	75.5	81.0	90	71	82	79			6.33	160.8	1.05	20	17	1					
Mersing, Johore ..	88.2	74.0	81.1	90	72	85	76			2.57	65.3	0.63	19	14	3					
Alor Star, Kedah ..	89.1	75.1	82.1	92	73	83	77			16.57	420.9	2.76	20	19	3	2				
K. Trengganu, Trengganu	90.5	74.6	82.5	94	72	88	76			3.62	91.9	2.27	8	7	7					
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. ..	73.8	63.8	68.7	78	61	68	65	71.5		11.39	289.3	1.49	26	20	1	8	3			
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	73.0	58.5	65.7	76	53	66	62	70.8		10.18	258.6	0.99	26	24	5	2				

Compiled from Returns supplied by the Meteorological Branch, Malaya.

* Figures not received.

METEOROLOGICAL SUMMARY, MALAYA, JUNE, 1947.

Locality.	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day.	Number of days					Total	Daily Mean	Per cent.
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F			Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
										ins.	m.m.	ins.								
Ipoh, Perak ..	93.6	74.3	83.9	98	70	88	76			8.64	219.5	2.36	10	10	5					
Port Swettenham, Selangor	90.1	73.2	81.7	93	71	83	75	84.9	85.1	3.41	86.6	1.28	6	5						
Sitiawan, Perak ..	89.3	73.8	81.5	92	70	86	76			5.31	134.9	1.82	9	7	1					
Kuala Lipis, Pahang ..	89.7	73.6	81.7	93	70	81	77	84.1	85.7	4.63	117.6	1.82	9	9						
Kuantan, Pahang ..	89.3	73.7	81.5	92	71	81	77			6.13	155.7	2.32	12	10	2					
Bayan Lepas, Penang .	87.9	75.7	81.8	90	72	83	79			4.53	115.1	1.62	11	9	5		1			
Malacca ..	85.9	74.9	80.4	89	70	79	77			5.93	150.6	1.91	12	12	1					
Mersing, Johore ..	86.9	73.9	80.4	90	71	75	77			4.13	104.9	1.52	12	9	3					
Alor Star, Kedah ..	89.4	74.9	82.1	93	72	84	78			3.98	101.1	1.04	13	12	1					
K. Trengganu, Trengganu	89.1	73.7	81.4	91	70	80	77			6.79	172.5	1.96	17	13	4	1	2			
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. ..	74.2	63.7	68.9	77	61	69	66	72.0		4.24	107.7	2.66	11	6	1	3				
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	74.5	56.2	65.3	79	51	71	61	70.9		9.10	231.1	1.92	13	11	1					

Compiled from Returns supplied by the Meteorological Branch, Malaya.

NOTICE.

Department of Agriculture, Malayan Union.

The Director of Agriculture invites those interested to visit the Central Experiment Station and the College of Agriculture, Serdang, and also the other Experiment Stations, Agricultural Stations, Padi Experiment Stations, and Padi Test Stations, of the Department in various parts of the Peninsula.

Intending visitors to the Central Experiment Station should communicate with the Senior Agriculturist. Visitors' days at the Central Experiment Station are the first and third Wednesdays in each month. Intending visitors to the College of Agriculture should communicate with the Principal.

The Central Experiment Station and the College of Agriculture are situated about 14 miles by road from Kuala Lumpur and 3 miles from Serdang Railway Station.

Stations are listed below together with the addresses of officers to whom enquiries should be sent.

AGRICULTURAL STATIONS.

Kedah.

Gajah Mati Agricultural Station.—*State Agricultural Officer, Kedah, Alor Star.*

Kelantan.

Central Experiment Station, Kota Bharu.
Bachok Agricultural Station.
Pasir Mas Agricultural Station.
Melor Experiment Station.
State Agricultural Officer, Kelantan, Kota Bharu.

Penang and Province Wellesley.

Ayer Itam Agricultural Station.
Bukit Mertajam Agricultural Station.
Agricultural Officer, Penang and Province Wellesley, Butterworth.

Perak.

Simpang Lima Agricultural Station.
Selama Agricultural Station.
Agricultural Officer, Perak North, Taiping.
Kuala Kangsar Agricultural Station.
Ayer Tawar Agricultural Station.
Agricultural Officer, Perak Central, Kuala Kangsar.
Degong Agricultural Station.
Tanjong Malim Fruit Nursery.
Agricultural Officer, Perak South, Teluk Anson.

Selangor.

Central Experiment Station, Serdang.
Experiment Station, Kuala Lumpur.
Coconut Experiment Station, Port Swettenham.
Senior Agriculturist, Central Experiment Station, Serdang.
Cheras Agricultural Station.
Telok Datoh Agricultural Station.
State Agricultural Officer, Selangor, Kuala Lumpur.

Pahang.

Kuala Lipis Agricultural Station.
Raub Agricultural Station.
State Agricultural Officer, Pahang, Raub.
Temerloh Agricultural Station.
Malay Agricultural Officer, Pahang South, Temerloh.

THE
Malayan Agricultural Journal
OCTOBER, 1947

EDITORIAL.

Reconstruction of the Malayan Pineapple Industry.

Among the established agricultural industries in Malaya, which incurred loss and damage as a result of the war, the pineapple industry has suffered no less than any other. On the planting side, the main planted areas reverted to rolling wastes of lalang grass, and in 1946 out of the 40,000 acres of pineapples grown as a sole crop only a few large areas on peat, amounting to about 6,000 acres in Selangor and South Johore, remained. These areas, although overgrown with weeds were found to be capable of resuscitation and, along with a few hundred acres of new plantations, in the Pontian district of Johore established towards the end of the occupation period, comprise all that is now left of the former, flourishing plantation industry.

On the canning side in 1946 out of seventeen pre-war canneries only one was intact, two had been completely destroyed, five had become derelict from neglect, and nine had sustained varying degrees of damage.

From 1930 onwards, developments in the cultivation and canning of pineapples in Malaya were considerable, and, whereas the crop was formerly grown mainly as a catch crop with young rubber, by 1941 about two-thirds of the total area, which exceeded 60,000 acres, was under pineapples as a sole crop.

In the early days of the industry the canned fruit obtained a ready market, but, with extension of pineapple canning in other countries and competition from a wide range of other canned fruits, it became necessary to reorganise the industry on modern lines. Finally a "Central Board of Pineapple Packers and Growers Association" was formed in 1939, by which time considerable improvements in canning methods had occurred, market grades were introduced and re-equipment of the factories with the most up-to-date machinery was contemplated and the re-organisation, supported by legal authority, had given the industry valuable support which, it was hoped, would place it on a sound basis.

Mr. C. E. Courtenay, who had considerable pre-war experience on the commercial side of the Malayan industry, has now been engaged by Government to advise on reconstruction, and Mr. F. C. Cooke, A.R.C.S., B.SC., A.M.I.CHEM.E., of the Department of Agriculture, has been appointed Canning Officer at the former pineapple Canning Research Station, Johore Bahru, to work and advise on research in manufacturing problems. A

committee was appointed in May 1947 under the chairmanship of the State Agricultural Officer, Johore, and is engaged in drawing up detailed plans for the immediate and long-term development of the industry. Departmental activity has also begun in connection with cultural problems and post-war reconstruction is now well under way.

The article by Mr. Courtenay, published in this issue of the Journal, forms the first of a series, which will be published from time to time, on the measures undertaken to bring about this rehabilitation. Mr. Courtenay points out that the task confronting the industry is not one of re-establishment on the pre-war basis, but of reconstruction according to a new design in which little of the former structure can be incorporated.

China Tea. Commercial production of Malayan tea commenced about 1927 and, by 1940, production of made tea from estates was approaching 1,600,000 lbs. of which more than half was sold locally, Imports of " Green " and " China " tea from China, for local consumption, amounted to between one and two million lbs. in pre-war years and consisted of both expensive, high-quality grades and cheap grades suited to the needs of the poorer sections of the local, Chinese population. Although the terms " China " tea and " Green " tea are commonly regarded as being synonymous, there is a distinct difference between the teas, in that, in the manufacture of China tea, a limited but controlled fermentation of the leaf is permitted whereas, in the case of green tea, the fresh leaf is steam-heated in order to destroy the enzymes of fermentation.

Experiments in the manufacture of green and China teas from Assam, Manipuri and China jats, growing at the Central Experiment Station, Serdang, were conducted in 1940-41. The results of these experiments are recorded in the article now published in this Journal and it is shown that high yields of green and China teas from Assam and Manipuri jats can be obtained and processed, and that the China tea can be placed on the local market to sell at competitive prices with similar grades of imported teas.

The green, or steamed tea, was not marketed locally or in London and its commercial possibilities need further investigation. Malayan black tea has always obtained a ready sale, both locally and on the London market, and these experiments at Serdang have shown how China tea can be manufactured locally not only by hand but also by the partial use of machinery normally employed in the manufacture of black tea.

Cattle in Malaya. The second in the series of articles, relating to animal husbandry in Malaya, appears in this issue of the Journal. The authors describe, the types of cattle kept in this country by Indian dairymen, labour forces, the local peasantry and by farms on the hill Stations and in the neighbourhood of large towns, where in the past small herds of cattle of European origin were maintained.

Native methods of feeding livestock are still primitive, pasture is inadequate and supplementary concentrates are provided in insufficient quantity. Herd management and controlled breeding are not practised

intelligently, and there is need for considerable improvement in all aspects of local animal husbandry in order to check the gradual deterioration in the quality of the cattle, particularly of the Indian breeds.

Practical measures, which could be adopted by local cattlemen to upgrade their stock, are discussed in the article and it is considered that elementary, selective breeding, within the existing herds, possibly in conjunction with the importation of good quality bulls from India, merits consideration as a first step in the improvement of the stock.

Advisory Service for Rubber Small-Holders.

In 1934 a " Small Holders Advisory Service " was established, by the Rubber Research Institute of Malaya, in order that the results of investigations conducted by the Institute should be made available to the small-holder. Asiatic Rubber Instructors, Malay, Chinese and Indian are attached to the Agricultural Offices in the districts to which they are posted and they work under the supervision of the Agricultural Officers in charge of these districts.

In 1941 the S.H.A.S. consisted of 41 Instructors and 20 Demonstrators and was directed by a full-time, Advisory Officer of the Rubber Research Institute. Many important improvements in care of the trees and in quality of the product were brought about and it was shown that, with proper guidance and assistance, the small-holder is fully capable of taking advantage of these improvements in methods which are applicable to his own circumstances.

Every effort is now being made by the Institute to re-establish this service and to increase its scope. The Staff is not yet up to full strength, but is being recruited as officers trained at the College of Agriculture, Malaya, become available.

A list of Instructors is published in the article dealing with the S.H.A.S. included in the present number of this Journal. The services of these officers can always be obtained, free of charge, on application to the appropriate Agricultural Office or direct to the Rubber Research Institute.

Original Articles.

THE RECONSTRUCTION OF THE MALAYAN CANNED PINEAPPLE INDUSTRY

I. The Pre-war Industry and the Problem of Post-war Reconstruction

BY

C. E. COURTENAY,

Adviser, Malayan Pineapple Industry.

In the series of articles to which this is introductory, it is proposed to give an account of the measures which are being taken to reconstruct the Malayan Canned Pineapple Industry after the devastation of the war years, and, in particular, to review the work of the Johore Pineapple Committee (or, to give it its full name, the "Resuscitation of the Malayan Pineapple Industry, Johore Committee) which, since May of this year, has been engaged in drawing up detailed plans for the immediate and long term development of the industry. Action has been taken, or is in process of being taken, on those of the Committee's recommendations which bear on the immediate task of getting the industry re-started with the minimum of delay, but, at the time of writing, the Committee has still to consider some important aspects of long term policy, and until it has formulated its recommendations on these matters and decisions thereon have been taken by Government, it will be premature to attempt a balanced account of its work.

But in the meantime it will be of interest to examine the historical background of the problems with which the Committee is dealing, as it is only by reference to the past history of the industry that the validity of the plans for its reconstruction can be properly assessed.

The Pre-war Industry.

During the period of 40 years prior to the last war, the canning of pineapple in Malaya developed from a small shop-house industry to become one of the largest single fruit-canning industries in the world. In 1937 which is the last pre-war year for which complete world figures are available, Malaya supplied the U.K. with 90% of its imports of canned pineapple and 25% of its imports of all canned fruits. The Malayan pack at 2½ million cases accounted for 27% of the world production of canned pineapple and 80% of the world export trade in this commodity.

But the picture of a well-established, prosperous industry which these figures seem to depict was largely illusory. The industry during its period of greatest expansion, in the 1920's and early 1930's, had depended for its fruit supplies almost entirely on pineapples grown as a catch crop on land newly opened for rubber planting. With the introduction of the Rubber

Restriction Scheme in 1931, packers were faced with a rapid shrinkage of supplies from this source and during the 4 or 5 succeeding years large areas of hilly and undulating jungle land were opened up in South Johore for the planting of pineapples as a sole crop. Unfortunately this new planting movement lacked proper co-ordination and control, the fugitive and unscientific methods of " catch crop " cultivation were perpetuated, and within a few years after planting most of these areas had suffered so badly from soil degradation and erosion as to have become useless for permanent cultivation.

The fact is that the change from " catch crop " to " sole crop " cultivation, to be successfully accomplished, called for a re-organization of the whole structure of the industry. Hitherto the expanding export trade had been built up on the basis of low price rather than sound quality. Malayan canned pineapple was the cheapest canned fruit of commerce, its price being normally less than half that of pineapple from other sources and 30% to 40% lower than the prices of competitive canned fruits such as pears, apricots and peaches. Low production costs had been made possible by catch crop methods of cultivation, cheap factory labour, and adherence to primitive methods of canning which involved a minimum of capital expenditure on plant and machinery. The establishment of the pineapple as a permanent plantation crop would necessarily have involved a substantial increase in the cost of fruit production, but the increase in the sale price of the canned product thus necessitated would still have left the Malayan packer in a strong competitive position on a price basis, and if the rise in price had been accompanied by an improvement in quality the effect upon the export trade would probably have been beneficial rather than the reverse. A change of this nature could be effected only by centralised co-ordination and control of planting, packing and marketing, but at this critical stage in its history, those engaged in the industry failed to appreciate the need for co-operative action, and it was not until 1938-39 that, with the formation of the Central Board of Pineapple Packers, a belated attempt was made to re-organize the industry to meet the new conditions with which it was faced. But before considering the reforms which were carried out by this body, it is necessary to describe in more detail the conditions which obtained in the industry prior to its formation.

Reference has already been made to the low quality standard of the Malayan pack. This was in part attributable to primitive methods of processing and inadequate supervision in the canneries, but the basic cause was the lack of organization in the plantation side of the industry and the inefficient methods of harvesting and marketing the crop. With few exceptions, packers had no control over the cultivation of fruit and no direct contact with the fruit growers. Much of the cultivation was carried out by small-holders from whom the fruit was bought by middlemen who transported it from the plantations and re-sold to the canneries. The small-holders were mostly in the clutches of moneylenders who, having

financed them during the period taken to open up their land and bring it into bearing, subsequently levied a toll (usually 30%) on all crops produced. The small-holder was also subject to exploitation by the middleman who constituted the sole means of marketing his crop. As a rule his net receipts amounted to little more than half the price paid by the canner, and provided barely enough for his subsistence, leaving no margin to finance proper methods of cultivation.

In the absence of any effective organization of growers, packers were unable to make long term contracts for the purchase of fruit, and they competed for supplies from day to day. Prices were therefore subject to constant, and often violent, fluctuations and these fluctuations had a marked effect upon the quality of the fruit delivered at the canneries. When prices were high, growers were apt to harvest as many pineapples as possible of the minimum size, whether ripe or not, in an attempt to cash in on their crops while the going was good, whereas when prices were low they would retard harvesting in the hope that the market would improve. Thus, during high price periods much of the fruit received at the canneries was immature, and during low price periods a considerable percentage of the fruit would be over-ripe.

A further factor which adversely affected the quality of the fruit delivered at canneries was the impoverished condition of the growers, who were often so pressed for funds that (particularly during the early parts of the seasons) they accelerated harvesting and cropped their fruit long before it was fully ripe. Also many of the holdings were too small for efficient harvesting. To obtain uniformly ripe fruit, pineapple plantations should be harvested at 3 to 5 day intervals during the fruiting seasons, but in the case of small plantations of 5 to 20 acres, such frequent cropping does not yield saleable quantities, and harvesting is usually carried out at longer intervals, up to 10 days or 2 weeks. This means that the grower, in order to avoid wastage, must harvest, not only the ripe fruit but also such fruit as he judges would become over-ripe if left until the next harvesting period.

It will be recognised that with these methods of cultivating, harvesting and marketing the fruit crop it was impossible for the industry to maintain regular and satisfactory standards in the grading of the pack, but, in addition, the production methods employed in the canneries were primitive and, judged by modern standards, inefficient. The cutting of the fruit was performed entirely by hand, and, although the Chinese operatives attained a remarkably high standard of speed and skill, the results could not compete in uniformity with the machine-cut packs of the Hawaiian and Australian pineapple industries. The grading of the cut fruit was often inadequately supervised, but it was in their method of processing the pack that Malayan packers lagged farthest behind their competitors.

Typically, a modern fruit-processing line consists of a Syruping machine, an Exhauster, a Can-closing machine and an Automatic Cooker

and Cooler. All the machines in the line have the same rate of output, the cans pass from one to the other and the whole process is continuous and automatic. The can containing the cut fruit first enters the Syruping machine, in which it is filled with syrup to the required level; and is then passed to the Exhauster in which its contents are gradually raised to a temperature of about 180 degrees F. The purpose of this operation is to expel the gasses dissolved in the juice of the fruit and to allow the fruit cells to expand without bursting. Also, when on emergence from the Exhauster, the can is closed, the water vapour rising from the surface of the syrup excludes the air, creating a vacuum in the closed can, thus preventing deterioration of flavour due to oxidation. The vacuum in the can serves to keep the ends of the can concave, and in the case of an " exhausted " pack, a bulged lid invariably indicates that the contents have become contaminated and fermentation has set in. Faulty cans can thus be readily detected by external inspection. After the cans have been exhausted and closed, they enter the Cooker in which they are cooked at a controlled temperature for a period accurately regulated to give the best result with the particular type of fruit being processed. From the Cooker the cans are passed to the Cooler in which their temperature is reduced to a point low enough to obviate a " secondary cook."

In Malayan canneries the exhaust process was omitted altogether. The cans, having been filled with cut fruit and syrup, were closed cold and then immersed in open vats containing water which was brought to boiling point by the injection of steam. The time of cooking was controlled only within very approximate limits, and after removal from the vats the cans were stacked honey-comb fashion and left to cool. The omission of the exhaust process not only adversely affected the appearance and flavour of the canned product, but was responsible for the prevalence of bulged lids which was a constant source of trouble with buyers and constituted a serious obstacle to the development of trade in some overseas markets. The pineapple, unlike many other canned fruits of commerce, is not readily susceptible to spoilage from over cooking, and the lack of accurate control of this operation in Malayan canneries and the secondary cook which took place during the cooling process, did not very seriously affect the quality of the pack, although contributing to some extent to the lack of uniformity in the final product.

The cans used in Malayan canneries were of the " hand-made " type, and each cannery manufactured its own supplies. This constituted a major obstacle to the mechanization of cannery operations, for this type of can is not suitable for use in conjunction with modern processing machinery such as has been described above. To work this machinery at or near maximum efficiency, machine-made cans must be used, as the requisite standards of uniformity of size and shape are unattainable by manual methods of can manufacture. But can-making by modern methods is a highly specialised industry. The plant required is costly, its operation calls

for a high degree of technical skill, and the volume of output of an economic unit is in excess of the needs of any except the very largest canneries. For these reasons, other important fruit-canning industries in all parts of the world had long since abandoned the practice of manufacturing the cans at the canning plants, and this operation had been centralized in large units from which canners obtained their supplies of cans ready for use. The more progressive of the Malayan canners recognised the desirability of a similar centralization of their can-making, as a first step in the modernisation of their canning methods, but they failed to achieve the measure of co-operation necessary to put a scheme of this kind into effect.

The failure to carry out this and other essential reforms on the basis of voluntary co-operation was largely due to the inclusion in the industry of a number of canners who had no permanent stake in its prosperity, were interested in it only as a source of quick profits, and who opposed any long term schemes for improvement which would entail an increase in their capital investment. In the conditions then prevailing, the erection and equipment of a cannery called for a comparatively small outlay, its operation demanded little technical skill, and as ample fruit supplies were available in the open market, the owner was under no necessity to establish his own plantations. Thus, during every period of prosperity, there was an outcrop of small, under-capitalised canneries constructed at the minimum of cost and operated on lines of irresponsible speculation which not infrequently ended in bankruptcy.

The unstable structure of the industry, and the violent fluctuations in production costs arising from the day to day competition for fruit supplies, rendered impossible an orderly disposal of the pack at fixed prices, and the marketing of the pack was characterised by speculative methods on the part of both packers and exporters. Forward sales in the early parts of the seasons were based, not on current costs, but on estimates (or guesses) as to the relation between supply and demand during the packing months, and the reaction of these factors on the price of fruit. This method of marketing resulted in erratic price movements, and even when market conditions were favourable, speculative selling and unregulated competition amongst packers often forced prices down to a level much below that which consuming markets would have been willing to pay.

But in spite of its defects, the industry enjoyed a considerable measure of prosperity until the early 1930's, when rapidly increasing fruit production coincided with depressed conditions in the world canned fruit markets. It was then that the dependence of the industry on low price rather than sound quality, and its failure to evolve any coherent organization to control production or to regulate marketing, had their effect, and although in a period of 7 years, annual exports were increased by 70%, this was only achieved by a progressive lowering of the price level which, in turn, led to a deterioration of conditions on both canning and planting sides of the industry.

In 1934, Government decided to bring the industry under legislative control in order to enable the enforcement of reforms, which, it was now apparent, were necessary for its survival. Accordingly the Pineapple Industry Ordinance was enacted, conferring on Government very wide powers for the regulation of the Industry. Under this Ordinance, Registrars of Pineapple Canneries were appointed with whom packers were required to register their canneries. The packing of pineapple without registration was made an offence, and regulations were promulgated setting out the conditions with which packers must comply to qualify for registration. The Registrar had power to refuse registration if these conditions were not complied with or if, in his opinion, the number of canneries already registered was sufficient for the requirements of the industry.

The first regulations made under the Ordinance were concerned with an improvement in the sanitary conditions at the canneries. It was intended to proceed with other regulations to enforce improved processing methods, but action was postponed at the request of the packers who maintained that economic conditions in the industry must be established on a sounder basis before it would be possible to raise the capital required to carry out these reforms.

The most important result of the enactment of the Ordinance was that by providing the means to control the activities of the less responsible packers, it created conditions favourable for the formation of a representative packers' association. Such an association was formed in 1938 under the title of "The Central Board of Pineapple Packers, Malaya." At the time the Board was formed, the industry was heading for bankruptcy. For many months past the price of a case of canned pineapple containing forty-eight 1½-lb. cans had remained at about $2.60, or about 5½ cents for a can containing the edible part of one and a half pineapples plus 3 ozs. of sugar. The price of fruit had fluctuated between 70 cents and $1.50 per 100 delivered to the cannery; and, in the more remote areas, crops were being left to rot in the fields.

In these circumstances the first concern of the Board was to establish a higher price level for the pack by controlling production on a quota basis, and centralising the sale of canned pineapple in the hands of its Trade Committee, and by these means it effected a rise of about 30% in the price level in the space of about 9 months. In order to consolidate its position, the Board sought Government recognition as the Association representative of the canning side of the industry. This was conceded and membership of the Board was made a condition of registration under the Ordinance. In return, the Board undertook to co-operate with Government in carrying out the aims and objects of the Pineapple Industry Ordinance, and in its constitution it provided for the attendance of Government Officers at its meetings, the senior of such Officers present at a meeting being given power to decide on all matters in dispute.

In addition to the improvement in the method of marketing the pack, an important reform effected by the Board was that the sale of the fruit crop was brought under some measure of control. At intervals throughout each season, meetings attended by Government Officers, members of the Central Board and representatives of the growers, were held to draw up scales of prices to be paid for the various grades of fruit. In spite of some evasion of these price agreements, a large measure of stabilization was achieved and the price of fruit was raised to a more economic level.

Thus when war broke out the industry was in process of evolving a more satisfactory organization. The operation of the Pineapple Industry Ordinance had effected a great improvement in the hygienic conditions in the canneries, and the control exercised by the Central Board over the purchase of fruit and the sale of the pack had saved the Industry from economic collapse. But no appreciable progress had been made in the modernisation of canning methods, and in the vital matter of fruit supplies the industry was dependent mainly on plantations which were rapidly deteriorating and were doomed to extinction within a few years. Exception must be made of the plantations in the Klang district of Selangor and the Pontian district of Johore, where the pineapple was being cultivated on flat, peaty land. Generally, the pineapples grown in these districts were serving as a catch crop for rubber or coconuts, but there were some areas in which it had been cultivated as a sole crop, or in association with annual food crops, for periods up to 20 years with no apparent signs of soil exhaustion. These plantations constituted the nearest approach to permanent pineapple cultivation yet achieved in Malaya.

The Occupation Period and After.

During the Japanese occupation of Malaya, pineapple canning (except spasmodically and on an insignificant scale) was discontinued, and on the British re-occupation of the country in 1945 it was found that the main planted areas in the uplands of Johore had become rolling wastes of lalang. All that remained of the plantation side of the industry were a few peat areas in Selangor and South Johore, which, although overgrown with weeds, were found to be capable of resuscitation. In addition there were a few hundred acres of new plantations in the Pontian District of Johore which had been opened up towards the end of the occupation period, and planted with Mauritius and Sarawak pineapple to supply the fresh fruit market.

Of the 17 pre-war canneries, only one had survived unscathed. Of the others, 2 had been completely destroyed, 5 had become derelict from neglect and the rest had sustained varying degrees of damage and dilapidation.

The Problem of Post-war Reconstruction.

It will be clear from the foregoing account of the past history of the industry, that the task which now confronts it is not one of re-establish-

ment on the pre-war basis, but of reconstruction according to a new design in which little of its previous structure can be incorporated.

The following summary indicates some of the more important of the problems involved, and in other articles in this series it is hoped to give an account of the proposals made for their solution.

Fruit Cultivation.

Establishment of new plantations in which the pineapple will be cultivated as a permanent crop.

Planned development of the new areas, including access roads, internal transport arrangements and drainage.

Improvement in the quality of the crop by control of cultural methods, and the selection and propagation of the most suitable varieties of fruit for canning.

Organization and control of small-holder planting.

Maintenance of a proper balance between small-holder and capitalistic cultivation.

Control of prices to be paid to growers for various grades of fruit.

Canning.

Modernization of processing methods.

Provision for supply of machine-made cans.

Establishment of standard grades of quality for canned fruit.

Elimination of the unstable, opportunist canners from the Industry.

Regulation of supplies of fruit to canneries during the transition period when canning capacity will be greatly in excess of fruit supplies.

Development of production of subsidiary products to utilize fruit now wasted at the canneries.

General Organization of the Industry.

Establishment of a Joint Control Board or similar body to provide for collaboration between all sections of the industry.

Reconstitution of the Central Board of Pineapple Packers to meet the new conditions.

Organization and control of marketing of the pack.

Drafting of legislation to give effect to the reforms outlined above.

Received for publication, 20th August, 1947.

CHINA TEA

Manufacturing Trials at the Central Experiment Station, Serdang

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Introductory.

China tea has been a well known commodity on the London market from the beginning of the nineteenth century and was a familiar beverage in English households long before black tea was produced.

In Malaya, before tea appeared on the local market, decoctions of herbs were consumed primarily for medical purposes but also as mild stimulants; as trade developed between China and Malaya, tea was imported as a beverage to meet the needs of the Chinese community.

China tea has now become an important Malayan import as can be seen from the following abstracts from published statistics.

Net Imports of Green and China Tea into Malaya 1935 to 1940.

Year		Quantity lbs.	Value $
1935	..	1,384,957	507,068
1936	..	1,587,405	498,135
1937	..	1,971,326	625,962
1938	..	1,295,060	332,145
1939	..	880,294	241,515
1940	..	3,015,509	916,653

The above statistics do not differentiate between green and China tea, but the figures can be taken to represent China tea almost exclusively.

The grades of tea principally marketed in Malaya up to 1941 were as follows:—

(a) " Bohea Chui Sen ":—This tea is considered by many Chinese connoisseurs to be the highest grade tea produced. It was sold to discriminating consumers at from $2 to $12 per lb.

(b) " Thek Kwan Yin " retailed at $1.80 to $6 per lb.

(c) " Peh Moah Kew " sold at $1 to $4 per lb.

(d) Oolong (Formosan tea) sold at 50 cents to $1 per lb.

Notes on the Tea Industry in China.

The cultivation of tea in China is mostly a cottage industry; it is produced on holdings which seldom exceed ten acres and the processing is carried out by hand methods.

Cultivation and Care of Bushes.

Vegetative propagation is usually adopted by layering side branches of selected bushes; after the layers have developed roots they are lifted and transplanted in new areas or used to fill vacancies in established fields. Plucking commences two to three years after planting. The China jat unlike the improved Indian jats will flower and fruit when the bushes are in full plucking and, for this reason, it is unnecessary to establish gardens for the production of seed. On occasion seed is collected and planted direct in the field on the permanent sites of the bushes. The bushes are dormant during the winter, but as soon as growth commences in the spring heavy plucking is customary and keeps the tops of the bushes low and within easy reach of the pluckers.

The yield is low, since manuring is not practised, and it can thus be appreciated that pruning is seldom necessary. Occasionally tall bushes, particularly if they are not making new growth, are slashed, and this has a stimulating effect in promoting vegetative growth.

Thus it is evident that tea cultivation, on small holdings in China, amounts to an exploitation of the land, growth depending solely on the inherent fertility of the soil. The disparity of yields is great in comparison with those obtained under modern scientific methods of cultivation and manuring, as adopted in the production of black tea.

Plucking routine.

Owing to the marked, seasonal changes in climate, plucking cannot be undertaken during the winter. The best teas are made from the earliest pluckings in spring when growth is slow and the intervals between pluckings fairly long. About ten to sixteen plucking rounds per annum are made at intervals which vary with the season. During late spring and early summer, when growth is vigorous, the period between pluckings may be as short as five days; later in the year when growth is slower it may gradually be extended to twenty days.

The quality of tea to be manufactured will determine the methods of plucking. If high-grade tea is the objective three leaves are taken and the lowest leaf is sorted out for processing, separately, as a low-grade product, the two upper leaves being made into a better quality tea. If maximum yields are sought, coarse plucking is adopted giving a product which is sold cheaply.

Manufacture.

The leaves are processed by many different methods, resulting in teas of distinct type and quality. In all processes of manufacture, the leaves are permitted to undergo a limited fermentation which has a fundamental influence on the characteristics of the finished product. Generally the methods of manufacture, with slight modifications in detail, are as follows.

When the leaves have gone through the required withering and fermentation process, they are partially heated in shallow, iron pans and

rolled by the hands and feet and afterwards dried over a charcoal fire in bamboo trays.

To enhance the attraction of many low grade teas, exotic aromas and flavours are imparted during the process of manufacture by admixture of freshly cut, fragrant flowers. The species of flowers usually used are *Pergularia odoratissima,* (Tonkin creeper), *Jasminum sambac,* (Jasmine), *Chloranthus inconspicuus,* and *Osmanthus fragrans.*

The greater portion of the high grade teas imported into Malaya is grown in the Fukien province, which is favoured by a suitable climate and altitude for the production of quality teas. The best teas come from the Bohea mountains of the Fukien province and command very high prices.

China Tea from Formosa.

A large quantity of "Oolong" tea grown by Chinese settlers in Formosa is also shipped to the world's market, and a fair portion of this tea is imported into Malaya. In the manufacture of these teas endeavours are made, with a fair measure of success, to imitate in appearance the high-grade China teas. The Formosan teas, however, possess their own distinctive characteristics by virtue of which the teas command a place in the world's markets.

Classification of Tea.

There is some confusion concerning the classification of teas, other than the black tea now almost universally consumed. Although China tea is commonly regarded as being synonymous with green tea, there is, however, a distinct difference. In the manufacture of China tea, a limited but controlled fermentation of the leaf is permitted. This has a fundamental influence on the characteristics of the finished product, whereas the first process in the manufacture of green tea is steam sterilization of the freshly plucked leaf, which destroys the enzymes of fermentation and results, on infusion of the leaf, in the production of an almost colourless but pale yellow liquor.

The colour and characters of tea infusions, in general, are influenced by the tannins in the leaf; (6) these belong to the Catechol-tannin group. During the fermentation process in the manufacture of tea, the enzymes interact on these tannins, forming substances of varying solubility and colour ranging from pale-yellow to light-red and brown, which account for the colour and some of the characteristics of tea liquors. In the manufacture of black teas it is stated by tea chemists (4) that much of the caffeine combines with the tannin to form caffeine tannate which inactivates the caffeine, whereas the processes employed in the manufacture of green and China teas leave the caffeine mostly unchanged, and this accounts for the greater stimulating effects, particularly of high-grade China teas, as compared with black teas.

Manufacture of China Tea at the Central Experiment Station, Serdang.

Trials in the manufacture of China tea were undertaken during 1940-1941. The figures mentioned in this article, in relation to manufacturing costs, market prices and sales, are based on the prevailing wages and market conditions at that time. In the manufacture of China tea, leaves from Assam, Manipuri and China jats were used, the objects being as follows:—

(a) To obtain information on the Chinese hand process under local conditions.

(b) To experiment on the possibility of producing fair quality, China tea by partial use of black tea machinery with the ultimate object of encouraging local production.

Manufacture by the Chinese Hand Process.

Building.

A portion of a building, 12 ft. x 28 ft. x 8 ft. to the eaves, was adapted for use as a factory. The factory was enclosed on two sides by weather boards; the third side was open and the fourth side was constructed of brick and concrete, along which two fire places were constructed. These were surmounted by two shallow cast iron pans, ("kwalis")* set to lean forward at an angle of about 30° from the horizontal, with the top rim facing forward to the inside of the building. The fire-hole doors were arranged outside the building so that smoke could not enter the building, but was conducted along flues to a central chimney. This method of construction and stoking of fires does not interfere with the workers while they are attending to the treatment of leaf in the pans, and they are also relieved of the necessity of standing near to open fires.

These "kwalis" are suitable for manufacture of hand-made tea and could be installed in factories where the ordinary black tea machinery may be partly used in the manufacture of China teas.

In addition to the "kwalis", four cylindrical fireplaces called "poeylongs" are sunk into the floor; each is 2 ft. in diameter and 1½ ft. deep constructed of bricks and mortar and utilizes charcoal fires for the intermediate and final firing of the tea. Good quality charcoal is necessary to obviate the production of smoke within the factory, and to prevent smoking of the tea.

Additional appliances which are necessary are as follows:—

(1) Four, specially designed, cylindrical, closely woven, bamboo baskets 2 ft. 6 ins. in diameter and 2 ft. 6 ins. long, having open ends and a "waisted" construction with an inside, central rib on which can be placed a circular, fine-meshed, bamboo sieve to hold the leaf whilst it is being "fired" over the "poeylongs." The weave of these baskets is important and a close,

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* "Kwalis" are wide, shallow, cast-iron boiling pans.

simple, diagonal weave is preferable to one in which the strands are interwoven with a skeleton of ribs at right angles. The latter form of weaving provides interspaces through which the heat is lost.

(2) Four additional trays to cover the upper opening of the bamboo baskets to retain the heat while the firing is in progress.

(3) One bamboo, circular tray, 4 ft. in diameter, which is suspended from a beam by three ropes and is used for aerating the leaf.

(4) One rectangular mat 2½ ft. x 5 ft. constructed of woven bamboo, having the ordinary woven, uneven surface, on which the leaf is hand-rolled; this type of surface facilitates the twisting of the leaf.

(5) One wooden tray, 4 ft. x 4 ft. on which a secondary rolling of the leaf takes place.

In a factory of the dimensions quoted, and employing the above appliances, an output of about 70 lbs. of hand-made tea can be turned out per day.

Plucking.

In the manufacture of China teas, the unopened, rolled leaf at the end of the young growth, does not, after processing as in the case of black tea, produce a " tip " which has a high sales value. The process results, instead, in the development of a greenish colour in the manufactured leaf which impairs the appearance of the finished product.

Tea dust and small particles have, also, little commercial value in China tea. It will be appreciated, therefore, that the production of these grades must be avoided as far as possible and that their elimination should commence from plucking.

The optimum time for the development of two or three leaves, ready for plucking, in the Assam, Manipuri and China jats at Serdang is approximately 7 days for 2 leaves and 12-14 days for 3 leaves. Coarse plucking results in the development of a bitter and very astringent liquor which should not be confused with the normal taste or flavour of tea. Stalks are excluded as far as possible from the plucked leaf. " Bangi "† leaf if young and tender may be included, but if mature and tough, having been over-looked for one or more pluckings, should be plucked and discarded.

On no account must leaf be allowed to lie about in large heaps or in baskets, particularly if it is compressed, or fermentation will commence to the detriment of the quality of the finished tea. The plucked leaf requires to be transported to the factory as frequently as is practicable; in any case it should not lie about longer than three or four hours.

Records at this Station show that the yield of leaves, under a system of fine plucking (two leaves and a bud) for manufacture of black tea, has averaged 3,601 lbs. green leaf, equal to 846 lbs. of made tea per acre. Some experimental plots have yielded more than double this figure. The estimated yield of made tea per acre, grown by Chinese squatters in Selangor, is about

† " Bangi " is a mature leaf at the end of shoots which have stopped growing.

466 lbs. The yield per acre in China is reported to vary between 400 and 500 lbs. The small areas of the China jat at the Central Experiment Station, Serdang, which show little variation in type, were established by the planting of seed purchased from squatters in the neighbouring district of Sungei Besi.

The ordinary method of the establishment of seedlings in nursery beds was adopted, with subsequent transplantation of seedlings or stumps into the field.

There appears to be no reason why greatly enhanced yields, over those obtained by Chinese squatters both in Malaya and China, could not be obtained by modern methods, which would of necessity include soil conservation and liberal manuring.

Hand Manufacture of China Tea in China.

Variations occur in the hand processing of tea in different districts of China, but, in general, the manufacturing methods adopted are as follows:—

The leaf is withered under shade, usually on the floor of the factory, for a period of 4 to 6 hours; the rate of spread being 1 lb. of leaf to 2 sq. ft. of floor space. It is undisturbed for the first 2 to 3 hours, after which, at intervals of 20-30 minutes, it is placed on the suspended bamboo tray and agitated by a jerking movement of the tray for about five minutes, after which it is again spread for further withering. During the second 2 to 3 hours the aeration of the leaf is alternated with withering, during which time the leaf assumes a light-brown colour, which is more pronounced along the edges. A chemical change, which includes slight fermentation, takes place causing a distinct aroma to develop in the leaf.

When the light-brown colour has spread over about one third of the surface of each leaf, the batch is ready for the first heating to destroy the enzyme of fermentation. This is carried out in the "kwalis" which have previously been heated to a temperature of 280°F. to 300°F. The leaf is then loaded into the pans and this temperature is maintained. In order to prevent scorching, the leaf is constantly turned by the use of a wooden paddle for a period of about 10 minutes. After the leaf has become flaccid, it is taken out and hand-rolled on the rough-surfaced, bamboo mat for about 10 minutes. It is then rolled a second time, usually on a smooth surface of boards. A certain amount of juice, which is discarded, is extracted by pressure of the hand during the rolling. The leaf is then aerated by spreading on the board and is then allowed to cool for about 15 minutes. After cooling, it is put on the small trays inside the baskets over the "poeylongs" and dried for periods of 5 minutes at a temperature of about 105°F. which is recorded on the surface of the drying tea. After each heating period it is removed, turned and mixed to obtain an even drying. This process is repeated about three or more times until the leaf is half dried. It is then placed in a dry, cotton bag and compressed by

twisting the ends of the bag in opposite directions to fix, to some extent, the twist on the leaf and coalesce the fine particles of tea dust to form "gun powder" tea. This twisting also removes excess moisture and carries away some tannin. After this treatment, the balls of rolled leaf are laid in small heaps on the tray over the "poeylong" for further drying.

When the tea is almost dry it is removed, and the finer portions, in the form of "gun powder", corresponding to "fannings" and "dust" in black tea, are removed from the bulk by the use of bamboo sieves. The two portions are fired separately at the same low temperature over damped-down "poeylong" fires. Drying in this manner is continued until the leaf is crisp and brittle. The process is more one of drying than of firing, in order to conserve the essential oils in the tea which impart flavour and aroma.

The drying in the "poeylong" is considered to be of vital importance, and the fires are always damped down to emit a regular flow of heat at a fairly low temperature. The fire is started at the bottom of the "poeylong" by igniting fairly large pieces of charcoal by the use, preferably, of a few glowing embers of charcoal, and the "poeylong" is then completely filled with charcoal. As the fire grows in intensity, and when the whole of the charcoal is aglow, it is rammed by the edge of an iron tool, such as a spade or a "penkali,"‡ which consolidates and reduces the fire to about half the original depth. The "poeylong" is then filled with paddy husk which burns and gives an even glow of heat for a period of 3 to 4 days.

The flavouring of China tea, by the use of fragant flowers as previously mentioned, is carried out before the tea is completely fired. The final firing process is interrupted by the removal of leaf from the drying tray, at which time the flowers are added in the proportion of about 1 to 3 per cent. of the half-made tea. The flowers may be used two or three times. The mixture is sometimes stored overnight in an earthernware jar and fired the following morning. After firing, the flowers are picked out of the made tea. Samples drawn from stocks, made by this method at Serdang, were valued by Chinese tea merchants in Kuala Lumpur at 40 to 48 cents per kati, wholesale, which would permit a retail price of 60 to 65 cents per kati.§

The results of trials at Serdang showed that, without the addition of flowers, a medium-grade China tea could be made by hand methods, but that high-grade teas could not be produced. Serdang is not favoured with the necessary sub-tropical climate, or the requisite altitude, to provide climatic conditions suitable for the production of high-grade teas.

Whilst such teas can be made by Chinese squatters and their families where labour charges are not so important, it is out of the question to apply hand methods to an estate output. Accordingly experiments were initiated at the Central Experiment Station, Serdang, to evolve a method by which

‡ Penkali—An Indian tool used for digging post holes.
§ Kati = 1⅓ lbs.

black tea machinery could be utilized to eliminate the excessive labour charges involved in the production of hand-made teas, and still produce a tea, possessing the required characteristics of medium-grade tea, acceptable to the labouring and peasant classes of Chinese.

Machine-made Green Tea Produced at Serdang.

The machinery used at Serdang for the manufacture of this tea is described below:—

1. Boiler for generating steam.

2. Hexagonal drum made of 1/16 in. galvanized iron plate, 5 ft. 9 in. long and 2 ft. 6 in. wide, with a perforated steam pipe running through the central bearings and extending to the full length of the drum, with a steam intake at each end. This drum revolves at a speed of 15 revolutions per minute and is fitted with a tight door the full length and breadth of one face of the hexagon. A drum of this size, when three-quarters full, will process about 150 lbs. of green leaf per charge.

3. Tables constructed of reinforced concrete set onto an angle-iron frame, having three tiers, for cooling and draining the steamed leaf.

4. One " Little Giant " tea roller.

5. " Venetian tea dryer ", for drying the leaf by hot air.

The dryer, operating at a temperature of 225°F. will dry about 70 lbs. of wet leaf per hour. In practice the drying rate varies with the moisture content of the leaf loaded into the machine.

6. A cylindrical drum, 3 ft. long and 1 ft. 7in. in diameter, having three baffle plates fitted inside from end to end, at an angle of 45° with the perimeter of the drum. The drum is revolved on a central shaft supported by bearings at each end; beneath the drum a charcoal fire is carried on a low tray fitted with two small wheels at each end in order that the fire can be placed under the drum or withdrawn as required.

Manufacture.

The fresh leaf, namely a bud and two leaves as plucked from Indian jats for the manufacture of black tea, is heaped in the factory in lots of 150 lbs. to undergo a slight fermentation for a period of about one hour.

The partially fermented leaves are then placed in the hexagonal metal drum, which has been previously warmed by injecting steam into it for about 1 minute before loading with leaf.

When the drum is loaded with leaf, steam is admitted at about 50 lbs. pressure, and the drum is then revolved for 2½ minutes at a speed of about 15 revolutions per minute. If the steam is admitted at a lower pressure the process takes a longer time. The leaf after being subjected to the right degree of steaming is firm and pliable, and emits a fresh smell. It breaks with gradual pressure but does not snap; the colour is a dull, even green. If the leaf is under-steamed it is bright-green, uneven in colour, and breaks during rolling; the liquor of such teas after completion of the process lacks character. The leaf when over-steamed is dull-brown in colour and smells sour, the stalks are soft and become squashy on rolling.

The following average weights and temperatures were recorded after steaming.

Weight of fresh leaf per charge	Weight of leaf after steaming and draining	Temperature of steamed leaf
150 lbs.	145 lbs.	167°F.

The steamed leaf is immediately removed to the concrete surfaced table on which it is spread to cool and to permit superfluous moisture, from condensed steam, to drain away. It is spread at the rate of about 1¼ lbs. per sq. ft.; thin spreading is necessary to permit dissipation of heat. About 20 minutes are required to cool the leaf sufficiently to permit rolling to commence. Weights recorded at Serdang were as follows:—

Average weight of steamed leaf after spreading on the table and draining	Average weight of leaf after draining and cooling on the table before charging the roller
145 lbs.	135 lbs.

The steamed leaf, when sufficiently cooled, is loaded in quantities of 65 to 70 lbs. into the tea roller. Additional moisture adhering to the leaf is removed by allowing the weight in the roller to rest on the leaf for a period of 3 to 5 minutes before setting the machine in motion. The leaf is rolled for 45 minutes, the roller moving at a speed of about 60 revolutions per minute. For the first 10 minutes pressure is applied; this is followed by 10 minutes without pressure. These times and pressures are alternated during the 45 minutes rolling, the last rolling with pressure being only of 5 minutes duration.

In the process of rolling, a large proportion of the moisture left in the leaf after steaming is expelled by screwing down the weight on to the leaf during the rolling. The following table gives the weights of leaf at this stage.

Average weight of steamed leaf per charge	Average weight and temperature of leaf after rolling	
67½ lbs.	42 lbs.	86°F.

The rolled leaf is passed to the dryer and fired at a temperature of 212°F. until it becomes crisp. The time taken to treat two charges of rolled leaf is about 90 minutes and produces 26 lbs. of dried tea. The temperature of the tea when discharged from the dryer is about 140°F.

The fired leaf from the dryer is allowed to cool overnight and is then loaded at the rate of 45 lbs. per charge into the cylindrical metal drum. The drum is revolved at a speed of about 15 revolutions per minute for two hours and fifty minutes over a slow charcoal fire. The fired tea in the drum is maintained at a temperature of about 195°F.

During this process the tea is examined at intervals of about half an hour, and, after it has reached the required stage of flavour, dryness and polish, the fire tray is withdrawn and the drum containing the tea is revolved

until the temperature falls sufficiently to permit handling of the tea. The drum is unloaded and the tea is sieved to remove dust. Twenty-six lbs. of fired tea give twenty-four lbs. of finished tea.

About 10 lbs. of charcoal are required to heat the drum during the polishing and flavouring process for each charge of 26 lbs. The weight of made tea is about 18 per cent. of the green leaf.

The estimated cost of labour and manufacture (1940-41) was as follows:—

	Cents per lb. of made tea.
Plucking (fine)	8.00
Labour and supervision ..	3.50
Power and light	1.00
Firewood	1.25
Packing	.50
Charcoal	.75
	15.00

The Manufacture of Cheap China Tea.

The following results were obtained in trials undertaken to produce cheap teas to meet the needs of the labouring class of Chinese.

The machines used were two " Little Giant " tea rollers, one 42 in. " Venetian " tea dryer and two cast iron " kwalis " each 42 in. in diameter.

Process "A". This process was adopted to produce a tea for general consumption. " Flush ", consisting of a bud and three leaves is plucked, and, on arrival at the factory, is spread on a cement floor (or on to tats*) to a depth of 4 to 6 ins. The leaves are allowed to wither and ferment for about 18 hours. During this period the leaf is turned and aerated once or twice. The object of this treatment is to cause even fermentation and withering.

Fermentation is then stopped by roasting the leaves in the cast-iron pans described previously. The withered leaf, in 50 lb. charges, is placed into the hot pan and stirred continuously by a wooden paddle to prevent burning. This process kills the enzymes and inhibits fermentation. The average period of firing withered leaf is 10 to 15 minutes.

The leaf now becomes flaccid and is rolled for 10 minutes. During this process a portion of the juice is extracted and the leaves acquire a twist.

The rolled leaf is then passed into the tea dryer and partially dried at a temperature of 230°F. The leaf at this stage is reduced to about 38 per cent. of the weight of fresh leaves.

* Tats are layers, usually of hessian, about 7 inches apart and 3 ft. 6 ins. wide constructed in tiers, on wood and wire frames in the withering lofts of tea factories, on which the freshly plucked leaves are spread to wither.

The leaf after treatment in the drier is placed in the hot pans and kept agitated for 1½ to 2 hours during which time it becomes crisp and begins to emit the characteristic odour associated with flavour. At this stage the leaf is sufficiently dried and is removed from the pan and stored in bins. The final drying of tea in pans requires great care in the regulation of the temperature; considerable experience must be gained to avoid scorching and to obtain satisfactory results.

The cost of manufacture of tea by this method was 2.31 cents per kati (or 1.73 cents per lb.) in 1940-41.

The tea was packed in sacks at the rate of 70 katties per sack, and 24.74 piculs of tea manufactured by the above method were sold during 1941 at $35/- per picul. (1 picul = 133⅓ lbs.), or 35 cents per kati.

Costs of producing black tea and China tea, and the market value of black tea (85% of the output) sold in London, and of black tea dust (15% of the output) sold locally, and of China tea sold locally, are compared below.

	China Tea cents per lb.	Black Tea cents per lb.
Field Charges ..	9.16	9.16
Plucking ..	3.10	6.20
Manufacture ..	1.73	7.45
Packing, transport and sales ..	0.10	7.40
Total Cost ..	14.09 cts.	30.21 cts.
Average value black tea (both grades) ..		41.68
Costs		30.21
Difference between costs and sales ..		11.47 cts.
China tea, sold ex-factory at 35 cts. per kati		26.25 cts. per lb.
Costs		14.09
Difference between costs and sales		12.16 cts.

It should be recorded that the power required in the manufacture of China tea is less than that necessary for black tea. Black tea costs were handicapped during 1941 owing to war conditions, a surcharge for steamer freight to London was levied and insurance rates amounted to 1.48 cents per lb.

From the above figures it will be seen that the field charges are assumed to be the same for both teas, but actual observations show that the plucking of China tea does not require the same amount of field supervision as for black tea, and therefore the cost of production can probably be further reduced. Moreover it may be seen from the table of

costs that the pluckers will bring in double the quantity of coarse leaf, for manufacture into China tea, as compared with the fine plucking required for black tea.

Process "B". This process was specially investigated to produce a tea to meet the demand by the Keh community, who prefer a tea with a greenish-grey colour, obtainable by stirring in a hot pan.

The withered leaves, after heating in the "kwali", are partially dried in the power dryer to remove a portion of the moisture in the leaf; afterwards it is rolled lightly in the tea roller. The rolled leaves are further dried in the tea dryer and finally dried in the pan. The cost of manufacture is about 4 cents per kati. The tea was valued (1941) at $35 per picul and 1½ piculs were manufactured and sold at the above price.

The results of experiments indicate that the manufacture of China tea by methods A and B can be undertaken with profit. The manufacture of tea by process "A" appears to meet the demand of many Chinese and therefore can be recommended for adoption on large estates.

In addition to the above, several other manufacturing processes were tried but are not recommended.

General Comments.

Tea made at Serdang has been tasted by local Chinese merchants and other interested persons, who considered it a satisfactory low grade tea. It commanded a ready wholesale price of about 30 cents per kati during 1941. It is considered that the quality can be much improved with experience in the manufacture, and it is not unreasonable to expect 50 cents* per kati, when the market is more fully exploited and the details of manufacture are better understood by the labourers, resulting in a more homogeneous product.

A tea artificially flavoured with jasmine, or other suitable flowers, is in local demand and commands a premium of about 6 to 10 cents per kati. If the cost of growing the flavouring flowers is considered to be too high, bottled perfumes, of which jasmine is one of the cheapest, may be used. These were being sold in Malaya during 1941 and were being used as substitutes for the fresh flowers. The spraying of partly processed tea by these perfumes reduces the labour costs of manufacture in comparison with the method of admixture of fresh flowers and the picking out of withered flowers from the finished tea.

Summary.

The investigations recorded above show that, in Malaya, the production of medium and low-grade China teas is possible by hand manufacture, or by the partial use of machinery normally employed in the manufacture of black tea. Furthermore, such grades of China teas can be placed on the local market to sell at competitive prices with similar grades of imported teas.

* (1941).

The altitude at Serdang, 160 to 250 ft. above sea level, with the normal wet tropical climate, 95 to 105 inches of rain per annum, encourages a steady growth of tea all the year round but is not conducive to the production of high-grade teas. The experiments have shown, however, that high yields of medium-grade China teas from Assam and Manipuri jats can be obtained and processed.

Such teas are acceptable by Chinese as possessing the characteristics of similar grades of imported China teas.

The experience gained at Serdang, in the manufacture of China tea, indicates that little difference in quality or type of made tea is obtained when Manipuri, Assam or China jat is used. The frequency of plucking has a marked influence on quality and fine plucking, i.e. down to one fully grown leaf and the newly opened leaf at the growing point, produces the highest grade teas.

Acknowledgements.

The writers acknowledge with thanks the assistance and suggestions, in the preparation of this article, of Mr. H. J. Simpson, Agriculturist in Charge, Central Experiment Station, Serdang, and of Mr. Aik Leong of Kuala Lumpur, for his reports and valuations of samples submitted to him during the course of the trials, and also for his contribution of much useful information on China tea.

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Received for publication, August 1947.

ANIMAL HUSBANDRY IN MALAYA

I. Cattle in Malaya (*Continued*)

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In Malaya there is an unusually wide diversity of objectives and methods in cattle keeping and this diversity is, in part, due to the fact that there are a number of different races of cattle owners involved, each tending to practise its own particular methods, and in part to the fact that different racial preferences and customs exist in different parts of the country. In the following sections the subject of cattle in Malaya is presented under the following sub-headings:—

(A) Cattle of Indian (Zebu) origin,
(B) Indigenous cattle,
(C) Cattle of European origin,

since this arrangement is in order of numerical and hence of commercial importance.

Cattle imported into Malaya up to 1941 came chiefly from Bali and, to a very much less extent, from Siam and French Indo-China; imports were mostly for slaughter purposes, imports of dairy cattle or of breeding stock being almost negligible.

A. Cattle of Indian (Zebu) Origin.

Indian cattle constitute the majority in Malaya as a whole, and are particularly predominant on the western side of the Peninsula south of Kedah. They are owned chiefly by Indian dairymen, and to a lesser extent by Tamil labour forces on estates, and are kept mainly for milk production, though there is also a considerable internal trade in surplus animals, particularly males, for draught purposes and for meat. A few estate companies also maintain their own herds.

In can be stated that although cattle in India have been developed from the same foundation stock, they have segregated into types probably influenced by environmental factors, but no doubt assisted, to some extent, by selection along certain lines.

Indian cattle in Malaya are fairly uniform in build and colour characteristics, there is however, in some herds, some variation in type, for instance a predominance of Ongole blood is manifested usually by the light-grey colour of their coats, but in many herds the fawn and dun

coloured cattle of Northern India predominate. The evolution of the Indian ox in Malaya would appear to be proceeding towards a medium to small-sized homogeneous animal, suited to the plane of nutrition available, which mainly consists of luscious fodder-grass of low nutritive value. Indian cattle keepers are very parsimonious in their feeding methods and only cattle in milk are, in general, supplied with a meagre addition of concentrates.

In the past, Indian immigrants imported large numbers of stock and it is from these importations that existing herds are descended. Some local owners claim that their cattle were imported from Southern India and others from the Punjab and the North, but it has not been possible to demonstrate any correlation between recognizable differences in build and type and district of origin as stated by the owners. This point has more than academic importance because there are two general types of cattle in India: and within these types, there are, as in Europe, what might be classed as distinct breeds:—

(a) The Northern breeds, which have in the main been selected and bred for draught purposes and milk production. The Northern breeds are inferior to the Southern for draught purposes, being slower and less active, but the yield of milk is double or treble that of the specialized working breeds of Southern India.

(b) The Southern breeds, which are, in general, draught animals and poor milkers.

Northern Indian Breeds.

The *Montgomery*, also known as the Sahiwal or Teli breed, is one of the best milking breeds. The horns are short, ears rather large and pendulous, hump fair sized, the skin and the coat are thin; the dewlap is large, and the sheath in the male and the fold of skin under the female well developed. The body frame is long, deep and massive, and is supported on short well-set legs. The colour may be black, grey, whitish, spotted or brownish-red. The cows have fairly well-developed udders and teats, and they yield up to about 3 gallons of milk per day when in full milk.

These cattle are reputed to lose some of their fine milking qualities when taken from their natural habitat (which is comparatively dry) to the more humid parts of the tropics; also they are said to breed more slowly. Despite this, the Montgomery has been used to a considerable extent for cross-breeding in India and to a limited extent in Malaya.

The *Scindi* breed is reputed to carry some of the best milking strains in India. These cattle resemble the Sahiwal but have a smaller and more compact body. The bulls have a slow gait and cannot be classed as good draught animals; they should interbreed with local oxen without unduly influencing the size of the progeny. In this respect it is considered that small-framed oxen, in general, thrive better, on the typical Malayan fodders of low nutritious value, than animals of the larger breeds, and, for this

reason, bulls of this breed should be useful for upgrading of milk production in Malaya.

The *Hansi, Hissan or Hariana* breed is found in the Punjab and neighbouring districts, and is, in many respects, like the Montgomery and Scindi breeds. The Hansi is considered by many to be one of the best all-round breeds in India. It is a general or dual-purpose breed, giving a fair yield of milk. The bulls are considered to be good draught animals, although somewhat slower walkers than the pure draught breeds, and are excellent in the plough or for drawing heavy loads.

These cattle are large, well developed, of various colours but mostly grey or whitish. They have large dewlaps but the males have only a small sheath. They are reputed to cross well with the Friesian.

Southern Indian Breeds.

The *Nellore or Ongole* breed comes from the Madras Presidency and is noted for its size and draught qualities being particularly suited for slow heavy haulage. They are not, therefore, particularly good for road work, and even the best cows of this breed very seldom yield 1½ gallons of milk per day.

The *Mysore* breeds are tall, active, muscular draught animals. They are exceptionally good for road work, and are the mainstay of South Indian agriculture as draught and ploughing bulls. Large numbers of this breed have been imported into Malaya in the past.

Despite the uncertainty as to origin referred to earlier, it is felt that the local Indian cattle are inferior to their parent stock in good districts in India, while the remarkable uniformity of build and type encountered in the majority suggests that the typical Indian cattle, now in this country, are, possibly, a genetically homogeneous mixture of the different breeds imported originally. The head is long and narrow, horns generally short and curved upwards and outwards, hair short and close, and the skin is pigmented. The body is light and narrow, with a tendency to height in front and lightness of the quarters—it is "slab-sided." The hump is most conspicuous in the males, being present to a variable degree in females. The "top-line" falls away steeply from above the point of the hip to a low-set tail head. The dewlap is fairly voluminous and the legs long.*

Indian cattle in this country are used chiefly for milk-production, though considerable numbers, particularly of surplus males, are used for draught purposes and for meat. The typical Indian milch cow in Malaya is ill equipped for the purpose of commercial milk production. The causes of this are mainly bad breeding methods and inadequate feeding.

Throughout Malaya the most elementary principles of animal breeding are ignored. Attempts to select superior sires are rare while uncontrolled breeding, with consequent inbreeding, is rife. As a consequence, the

* "Indian Farming," Vol. I, Nos. 2 and 3, contain comprehensive descriptions of many Indian breeds of cattle and bufflaloes.

average calf is of poor quality at birth, whether considered from the standpoint of physique or of its genetical inheritance.

Calves are almost invariably milk-starved from birth, since it is an economic necessity at present for the dairyman to sell as much milk as possible. This early sub-nutrition continues during the growing and adult stages, due to inadequate pasturage and insufficient supplementary concentrates, thus depressing the economic potentialities both of good and of bad stock alike. It is uncommon to differentiate between good and bad when apportioning the available fodder and concentrates, the use of communal feeding troughs being general. The combined result of the two factors mentioned above is to produce small to medium-sized, slow maturing animals, with a considerable proportion of weak and unthrifty individuals, and improvement in both breeding and feeding will be required in order to raise the standard of local Indian cattle.

The provision of adequate pasturage, or of fodder areas to permit stall-feeding, probably belongs to the sphere of official intervention, while only research will indicate the nature and quality of concentrate mixtures required to maintain good, average stock in a reasonable condition. To this extent, therefore, improvement lies outside the scope of the dairyman, and, in this connexion, it is of fundamental importance to remember the *economic* axiom that any extra expense and labour, incurred by superior feeding, must show at least an equal return in extra income, and preferably a handsome profit. Turning now to breeding we enter a sphere in which the local cattleman is in a position to start helping himself. Simple measures, such as early castration of scrub males (males unsuitable for breeding), and the early disposal of these, and of the more obviously degenerate females for meat, would be of considerable value and would entail but little expenditure either of labour or of money. Such methods, which represent elementary, selective breeding within the existing milch herds, possibly in conjunction with the importation of good quality bulls from India, probably represent all that can be accomplished in the next decade or so. If the measures mentioned above are not adopted feeding alone will be negatived and it is difficult to see how, otherwise, the past and present trend, which is one of gradual deterioration in quality, can be reversed.

B. Indigenous Cattle.

Malay cultivators in the rural parts of Kedah, North Perak, Kelantan and Trengganu keep considerable numbers of cattle, and these are almost entirely what might be termed moderate-sized, general purpose, draught-cum-beef stock of the Siam-Kedah breed.

These animals are of considerable interest, since they appear to be descendants of original stock which probably spread southwards from Siam. They do not appear to be inter-bred with stock from any other outside source and could probably be described as an indigenous breed, conditioned over a long period by the factors of local environment and local

methods of husbandry. They exhibit a certain measure of conformation to a type and the following characteristic features are, in general, representative.

(a) Head is broad and short, tending to flatness in the frontal region. Eyes prominent, ears small and pointed, tending to droop; horns small or average, of varying shapes; neck tends to be short, narrow and deep.

(b) Body is long, with well sprung ribs, full flanks, fairly broad back with a straight top-line from behind the hump to the tail head. Hump is usually well developed, particularly in entire males. Tail long and fine, with a switch almost reaching the ground. Udder in cows is small.

(c) Legs are short and finely boned, while predominant colours are red and red-duns†, though duns and blacks are not uncommon.

Compared with the typical Indian cattle on the western side of the Peninsula, the Siam-Kedah breed differs in the shape of the head (short and broad versus long and narrow); shape of body (broad, well sprung versus narrow and slab-sided); top-line (straight versus a rump which falls away from pelvis to low-set tail head); legs (short versus long) and size (moderate versus somewhat larger). The Siam-Kedah breed as a rule, appears to carry better condition than the Zebu and the animals convey the general impression of being compact, stocky, and hardy.

The Northern States of Kedah, Kelantan and Trengganu differ from the remainder of the States in the Peninsula in that they contain large tracts of flat country, much of which is cultivated, and relatively considerable numbers of livestock. The somewhat special position of cattle in Kelantan and Trengganu merits individual mention, but it is of interest to note in passing that Kedah is completely self-supporting in respect of beef requirements.

Kelantan.—There are large areas of cultivated land, on which both wet and dry padi and other crops are grown. The average size of holding is small and holdings are, therefore, numerous; ploughing is the general rule, and, as cattle are preferred to buffaloes for ploughing in all but the relatively small areas of low-lying swamp land, large numbers of cattle consequently are kept by the cultivators in this State. The small, sturdy Kelantan type, of the Siam-Kedah " breed ", is well adapted for the chief type of ploughing required; they are also excellent foragers and, given adequate feeding, produce a good carcase of beef.

Export of cattle from Kelantan is prohibited and slaughter for home consumption is controlled by a system of permits so that the Kelantan plain, in normal times, is markedly overstocked so far as ploughing requirements are concerned, with the result that there is likely to be a pronounced shortage of pasturage and fodder generally during the padi-growing season. During the off-season the cattle are grazed on the padi stubble, supplemented by

† dun = a dull greyish-brown colour.

cut grass and other grazing, and normally attain fair condition. During the padi season, however, herd movements to, in some cases, distant grazing areas are not uncommon. If this is not possible, the cattle are tethered and many owners walk considerable distances to find and cut fodder for their stock. When it is stated that half a hundredweight of grass is considered the usual daily ration for an adult animal the reader will realize how much work is involved by this procedure, particularly as special fodders for cutting are not grown to any appreciable extent.

Trengganu.—In the Besut area, conditions are similar to those of the Kelantan plain described above, except that the smaller density of raiat population, and consequently of cattle, provides for far more available forage. In other parts of this State, buffaloes play a greater part in padi cultivation than do cattle, with the general result that Trengganu is in a strong position for exporting surplus cattle.

The Malay, as a rule, keeps his cattle for draught and meat alone. It is very unusual for him to milk cows or to consume liquid milk, hence the calves usually receive a better start in life than do Indian calves. It must be remembered, however, that as a result of education and propaganda Malays are being taught to appreciate the value of milk in the human diet and this fact may, in future, result in a tendency to milk-starve the calves. The average raiat usually finds that the male is more suitable than the female for his particular purposes, and, in some parts of the country, he thus tends to get rid of his female stock, so that there is subsequently a shortage of dams.

The outstanding problem again is the provision of sufficient fodder or grazing, particularly during the padi season. The severity of this problem varies. It is particularly acute in Kedah, for example, but not much less so in Kelantan. It is suggested for future consideration that one solution of the problem would be to introduce rotation into padi cultivation, i.e. to set aside and use as grazing ground each year say one third of the sawah area, rotating the grazing and padi areas as in other systems of agriculture. However this may be, and only the future will elucidate the best methods, there would appear to be quite distinct economic possibilities for beef cattle production in the northern and eastern padi-growing areas of the Peninsula, designed largely to supply urban market requirements throughout the country. Animals of the Siam-Kedah breed appear to be quite well adapted to their environment, and would perhaps require less attention to the breeding aspects of improvement than, say, the Indian milch cow.

C. Cattle of European Origin.

Europe, particularly Western Europe, is the home of many breeds of cattle which, by virtue of their merit, have spread everywhere that is climatically suitable for them. One need only mention famous breeds such as the Ayreshire, Jersey, Guernsey, Friesian and Shorthorn to realize that this is so. Of these, only the Friesian, Guernsey and Jersey need be

mentioned in the case of Malaya, as these are probably the most likely European breeds to stand a chance of assuming any importance under local conditions. It should be understood, also, that under the heading of this section are included animals imported not only from Europe, but also from North America, South Africa and other countries where the European breeds have become established.

The *Friesian* Breed. This originated in Holland some centuries ago and is now numerically the strongest dairy breed in Britain, Holland, the United States of America, Canada, Australia, New Zealand and South Africa, and has established itself in a number of tropical countries for up-grading purposes in conjunction with *Bos Indicus* the Indian Ox.

The cattle are large, well fleshed and of true milking type, being coloured almost invariably black and white. The head is fairly long and should possess a wide muzzle and nostril. The neck is of normal dimensions. The chest is deep and thick, the back is wide, with well-sprung ribs and wide, flat loins. Hindquarters are wide, thick and long, and heavier than in most milking breeds. These animals, provided that adequate rations are available, are, in general, bigger than most dairy breeds; they carry more meat and fatten easily, while the calves are said to make good veal.

The breed is noted for its high yield of milk, many of the best cows producing in excess of 20,000 lbs. (say 2,000 gallons) of milk a year. The fat content, normally is lower than most of the other dairy breeds, as shown by the following averages:—

Jersey—5.4%. Ayreshire—4.0%. Friesian—3.4%.

In some countries the fat content is too low by itself to pass the legislative minimum standards of milk for consumption. In such cases, farmers frequently keep a few Jersey or Guernsey cattle so that by mixing the two milks the fat content of the mixture may be raised to the required standard. Friesian milk is particularly good for cheese manufacture.

The *Jersey* Breed.—This is possibly of French origin and is considered by many to be the oldest and purest milk breed. It has been isolated and bred for some centuries in the island of Jersey, which lies in the Channel separating England and France. Importation of cattle into Jersey has been prohibited for the last 170 years or so, hence the breed has been maintained very pure and free from diseases such as tuberculosis.

This breed is a milking type, the cows being wedge-shaped small, finely boned and fine skinned. Prevalent colours are fawns, browns and greys, while the presence of a light-grey ring around the muzzle distinguishes the Jersey from other Channel Island breeds such as the Guernsey. It carries very little flesh and is of very little value for meat purposes.

Yields are moderate, but the milk is very rich in fat and protein, and is very suitable for butter-making.

The *Guernsey* Breed.—It is thought that this breed, which has been gaining popularity during the past decade, possesses characteristics which would make it well worth a trial on the tropical highlands.

The Guernsey is generally considered to be more hardy while possessing the good qualities of the Jersey breed contained in a better-fleshed body, such as a fine skin, light thin coat and a medium sized body, which is preferable to the large breeds in so much as small animals thrive better on meagre supplies of fodder of low nutrition value. Cows of this breed give high yields of milk with a fairly high fat content.

The Friesian and Jersey are the most important of the European breeds in Malaya, though before the war there were very few even of these. Such animals are normally kept in certain commercial farms, usually situated near large towns or at upland places such as Maxwell and Frasers' Hill-Stations and Cameron Highlands. They are usually under expert European supervision and, in general, lead a very artificial existence. At one lowland establishment for instance, artificial ventilation and air-conditioning was provided before the war. Such methods can never form part of general animal husbandry in Malaya; they are economic only because there is a definite, though limited market for fresh milk in which price is relatively unimportant provided the quality is high.

It is contended by many authorities‡ that European breeds of cattle suffer from serious disabilities when maintained on the lowlands of the wet tropics. The heat controlling mechanism of European cattle is not adapted to high temperature with an atmosphere almost saturated with moisture particularly if this is associated with little seasonal variation in the climate. Most European breeds when stationed in the tropics also develop their characteristic temperate climate, winter coat, which increases the difficulties of the heat regulating mechanism of the animals. The unsuitability of tropical living conditions is manifested by a higher body temperature with increased pulse and respiration rates, with the consequent loss of efficiency of the animals. Furthermore, air movement in the tropics is normally at a slow rate which aggravates the prevailing conditions and makes it even more difficult for the animals to throw off surplus body heat.

Attempts before the war to breed and rear European cattle at Serdang and Singapore using a high plane of nutrition, resulted in undersized animals at maturity, with a high rate of infertility in female stock.

It is suggested that European cattle can remain healthy and vigorous in the wet tropics at an altitude which provides a mean temperature not higher than 65 to 70°F.

Allowing a fall in temperature of 3½°F. for each 1,000 feet of altitude and taking the mean temperature on the plains at 80°F. it will be seen that an elevation of about 4,000 feet is required to provide suitable conditions for European breeds of cattle.

The possibility of using European breeds such as the above for upgrading purposes under local conditions will be referred to later when considering the general problem of improvement of stock.

(*To be continued*).

‡ Norman C. Wright. Report on the Development of Cattle Breeding and Milk Production in Ceylon 1946. Sessional Paper XX, 1946.

THE RUBBER RESEARCH INSTITUTE OF MALAYA SMALL-HOLDERS' ADVISORY SERVICE

BY

L. R. DAVIDSON,

Small-Holders' Advisory Officer,

(Rubber Research Institute of Malaya).

Prior to 1934 the Rubber Research Institute had no means of direct approach to the owners of relatively small rubber areas. This was due to the small size of the holdings, their scattered distribution and the lack of suitably qualified officers to work in small-holding areas. With the development of the School (now the " College ") of Agriculture at Serdang suitably trained staff became available and a special advisory service to small holders was formed for the benefit of those whose principal interests were in rubber cultivation.

In 1934 the R.R.I. Small-Holders' Advisory Service (S.H.A.S.) was inaugurated with the appointment of 9 Asiatic Rubber Instructors. These men and all later appointees have passed the diploma course of the College of Agriculture, Serdang, and have received a further special course of training at the Rubber Research Institute in the practical aspects of rubber cultivation, collection and manufacture in accordance with good and well tried methods. Rubber Instructors are attached to the Agricultural Offices in the districts to which they are posted. They work under the day-to-day supervision of the Agricultural Officers in charge of the districts in which they are stationed. Guidance in advisory policy and provision of technical information likely to be applicable on small rubber holdings is given by the Rubber Research Institute. Malay Rubber Instructors now frequently have the assistance of Malay Rubber Demonstrators who are trained to repeat the simple lessons of tapping and sheet manufacture throughout the kampongs. These men also assist in budgrafting work, smoke-house construction, anti-erosion practices and treatment of the common pests and diseases.

The S.H.A.S. developed steadily up to the outbreak of war in the East, and by 1941 it consisted of 41 Instructors and 20 Demonstrators. The service was directed from headquarters by a full-time Small-Holders' Advisory Officer with the part time assistance of the Personal Assistant to the Director who had previously been a specialist advisory officer. By that date the production of slab rubber had been practically eliminated throughout the country and small-holders were producing fair quality sheet, sold either wet, air dried or smoked. Efforts were directed to the continued improvement in quality of the manufactured sheet and to ensure that the small-holder obtained a fair reward for the improved product. For those who

could be persuaded to obtain the extra profit from smoking, a special smoke cabinet had been developed suitable for use on the smallest holding. Full attention was always given to improvement in tapping methods and to limitation of bark consumption, and while these efforts, at the time, may have appeared to meet with only limited success, their fruits are becoming apparent now in the greater attention paid by small-holders to the tapping of areas planted during the last few years before the war. These areas bear testimony to the value of the work done on the replanting and new planting of rubber, and to the fact that given the materials, advice and encouragement the small-holder is fully able to take advantage of all improvements in methods which are applicable to his own circumstances.

The Small-Holders' Advisory Service has suffered a severe loss in the deaths on active service and in a prisoner-of-war camp of the two senior officers responsible for its pre-war development. The service was not maintained during the Japanese regime and we commence the post-war period with a depleted Staff. Every effort however is being made to maintain and increase the scope of the service and to shape it to the needs of the small-holder.

It is hoped that advantage will be taken of the relaxation of the restrictions on new planting and replanting and that a considerable development of young rubber areas will take place on small-holdings. Only the best proved planting material will be provided for this purpose. In making recommendations to small-holders consideration is given to their particular requirements, to the smallness of the units concerned and to the limited capital available.

While many faults in manufacturing technique remain to be corrected on individual holdings, really spectacular improvement in the finished product can now best be achieved if larger manufacturing units can be arranged. The S.H.A.S. is anxious to see extension of the development of Co-operative Societies amongst rubber growers throughout the country and works in close collaboration with the Co-operative Department. The advantages of co-operation amongst small-holders for the manufacture of sheet rubber may be summarised as:—

Improved equipment.

Provision of good water supply at limited over-all cost.

Ease of control of a few skilled workers under the direction of a mandor, and better division of labour between them.

Economy of acid through overnight coagulation.

Increased profit from better sheet, and the possibility of grading and bulk sales which can eliminate the middleman.

A few co-operative manufacturing centres with smoke-houses are already in existence and provide convincing evidence of the greater profit obtainable by small-holders who are prepared to co-operate. By co-operation it may also be possible for small-holders to sell their latex to concerns who are interested in the export of liquid latex. Further developments in the

production and co-operative marketing of latex by small-holders will be carefully studied.

Rubber Instructors seek work only amongst owners of their own nationality but this need not prevent a Chinese or Indian, for example, approaching a Malay Instructor with any rubber growing problems. Subjects of particular difficulty will always be referred to the Rubber Research Institute by Rubber Instructors. Recommendations are based on practical considerations, and small-holders are assured of sympathetic consideration of their particular problems.

A list of Rubber Instructors is appended. The services of these officers can always be obtained free of charge on application to the appropriate Agricultural Office or direct to the Rubber Research Institute.

Malay Rubber Instructors.

	NAMES		STATION
1.	Abdul Aziz b. Mohd. Jaafar	..	Kajang
2.	Abdul Rahman b. Haji Daud	..	Ipoh
3.	Abdul Rahman b. Panjang Aris	..	Telok Anson
4.	*Hussein b. Haji Alang Samsudin	..	Taiping
5.	Kassim b. Hassan	..	Kota Bharu (Kelantan)
6.	*Mohd. Aris b. Ahmad Fathil	..	Johore Bahru
7.	Mohd. Jamli b. H. M. A. Wasi	..	Batu Pahat
8.	Mohd. Johar b. Mohd. Rashid	..	Malacca (on leave)
9.	Mohd. Noordin b. Ahmad	..	Kuala Lipis
10.	Mohd. Piah b. Alang Mat Aras	..	Kuala Kangsar
11.	Mohd. Razalli b. Uda Yahya	..	Pekan
12.	Mohd. Rouse b. Haji Mohd. Amin	..	Sungei Patani
13.	Mohd. Shafii b. Haji Ludin	..	Rembau (on leave)
14.	Ramli b. Haji Abdul Rahman	..	Parit
15.	Samsuddin b. Mohd. Arabee	..	Klang (on leave)
16.	Shaharun b. Haji Abdul Rahman	..	Kuala Kubu Bharu
17.	Shamsudin b. Yub Ahmad	..	Kuala Trengganu
18.	Sa'ad b. Musa	..	Temerloh
19.	Wan Chik b. Abdullah	..	Kulim (on leave)
20.	Yahya b. Ma'amor	..	Muar
21.	Zainal Abidin b. Baharudin	..	Jitra
22.	Zakaria b. Haji Abdul Karim	..	Kuala Pilah

Chinese Rubber Instructors.

1.	Chan Seng Keat	..	Nibong Tebal
2.	Cheah Kwok Choy	..	Taiping
3.	Eu Eng Hoe	..	Kuala Lumpur
4.	Lee Choo Kooi	..	Ipoh
5.	Lee Yew Siong	..	Seremban
6.	Wong Cheng Boon	..	Muar
7.	Chai Hon Chee	..	Segamat
8.	Wong Mun Yun	..	Malacca
9.	Low Kai Choy	..	Batu Pahat

Indian Rubber Instructors.

1.	*Diaz, Gerard	..	R.R.I.
2.	Jebaratnam, M.	..	Taiping
3.	Muthucumaru, M.	..	Seremban (on leave)
4.	Samuel, John G.	..	Kuala Lumpur

* Superintendent Rubber Instructor.

Selected Articles.

STORED PRODUCTS PESTS* (ABSTRACTED)

Insect and related pests which feed on the wide range of commodities usually referred to as stored products are responsible for considerable losses in this State. Such commodities include grain and grain products, dried fruits and vegetables, nuts and nut meats, and products of animal origin such as ham and cheese as well as the numerous foods for both human and stock consumption which are prepared from one or more of these main classes of raw materials. The majority of the pests involved are either beetles or moths; the remainder make up a miscellaneous group which includes flies, psocids, and mites.

The beetles include several weevils but most of them are not true weevils, though they are commonly referred to as such. They are nearly all rather small, hard-bodied insects. Both the adults and larvae of these species feed in the infested material throughout their life and thus are usually found together. The adults of several species are very long-lived, some surviving for at least three years.

The adults of moth pests, on the other hand, do not feed on stored products and thus cause no direct injury in this stage of their life. Their mature larvae usually either leave the infested material before pupating or they pupate in such a position that the moths on emerging from the pupae may readily escape into the open. Thus the moths of these stored products pests are commonly found resting on the containers of the infested material, or on the walls of—or flying round—the building in which the goods are stored. In this stage, too, they live for only a week or two. The larvae of these moths characteristically spin silken threads wherever they go and also construct silken cocoons, this habit distinguishing them quite definitely from beetle larvae.

Pests in the miscellaneous group have no general characteristics in common. Psocids and mites are very small, the latter being scarcely visible to the naked eye. As in the case with beetles, all stages of psocids and mites are found together in the infested material. The adults of fly pests, on the other hand, are usually seen resting on or flying round the material in which their larvae are feeding.

Control of Stored Products Pests.

Merchants, farmers, and housewives may combat insect infestation of stored products by the adoption of a number of control measures. First and foremost among these is strict attention to sanitation in, and to the management of, the storage premises. Actual infestation may be reduced

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* Abstracted from Queensland Agricultural Journal, Vol. 64, Part 5. May, 1947. N. E. H. Caldwell, M.Agr.Sc., Horticulturist. Formerly Entomologist, Science Branch.

by the use of high and low temperatures and much good may be accomplished by spraying with appropriate insecticides and by the use of fumigants. These various control measures are discussed in the following paragraphs.

Sanitation and General Management.

The first essential in the control of stored products pests is strict attention to sanitation in all premises in which goods subject to attack by them are handled; all other control measures should be regarded as supplementary. Sanitation involves not only the maintenance of scrupulous cleanliness but also certain features of management aimed at eliminating, as quickly as possible, all breeding sites of the pests.

Most of the insects concerned in the infestation of stored products can live, and in many cases breed freely, in spilled goods and debris which may accumulate in cracks and crevices, in inaccessible corners, and under floors. Regular and thorough cleaning of the storage premises therefore is the basis of the control programme. If this is not attended to, contamination of fresh stocks begins as soon as they are taken into storage. In addition, the efficiency of other control measures, such as spraying and fumigation, is seriously impaired.

The construction of the buildings has an important influence on the question of sanitation. In a properly-designed structure the maintenance of the required standard of cleanliness is relatively simple; in a badly-designed building it becomes a difficult, if not an impossible, task. A good warehouse or store should have no dark, damp, inaccessible corners, and floors and walls should be free from cracks and ledges where debris may lodge. For this reason a smooth-finished concrete is the best type of construction. Any cracks in the structure should be filled with plastic bitumen or some comparable product, particular attention being paid to the junction between walls and floor. Regular applications of paint are helpful in sealing cracks in wooden walls and should be made with a spray gun, preferably after one of the periodical cleanings of the premises.

Walls, beams, and ledges should all be swept as well as the floors. Vacuum cleaners are particularly useful in cleaning corners and cracks and should be used in storage premises wherever practicable. Sweepings should be removed from the buildings at once and destroyed, preferably by burning. On no account should they be swept into a corner or under the steps or bagged and held on the premises for disposal later.

Certain commodities, such as bran, pollard and other stock foods, are more prone to heavy insect infestation than are highly processed goods. The risk of cross-infestation from the former is, therefore, great and accordingly stock foods should never be housed in the same premises as goods for human consumption. In the same way, even amongst the latter type of commodities, those particularly susceptible to insect attack, such as wholemeal flour, should, as far as possible, be isolated from other goods.

The correct rotation of stocks is an important phase of pest control work both in the home and in places where stored products are handled on a bulk scale. As a general rule, the oldest stocks on hand should be used first. Therefore, it is essential that a systematic method of stacking should be employed so that the oldest stocks are always readily accessible. All stocks, however, should be checked at frequent intervals and any which are unfit either for immediate consumption or for reconditioning should be removed at once and destroyed.

Since warm, moist conditions are usually favourable for the development of stored products pests, any measures designed to keep stocks cool and dry are worthwhile. In addition to the proper design and construction of buildings, such measures include the installation of fans, the use of dunnage under stacks to allow air circulation beneath them and a stack layout which permits maximum ventilation. Passageways should always be left between walls and adjacent stacks and between the several stacks. These passages should preferably be wide enough to permit a man to walk along them.

Control by Heat Treatment.

Heat can be used to control some insect pests and may, in certain cases, be applied easily and cheaply for this purpose. A high degree of heat is not required because most insects are killed if they are exposed to a temperature of about 125°F. for a few minutes. The chief difficulty in the application of this control measure lies in ensuring that the whole of the infested environment reaches the desired temperature, special provision being necessary to achieve this result. Even entire buildings may be heat-treated satisfactorily, especially in hot weather, provided they are well-built and specially equipped with a network of steam pipes for raising the temperature.

Heat is used to kill insects in a wide range of processed foodstuffs for which purpose specially constructed rooms are employed. These are fitted with controls to give a constant temperature of about 130°F. and the goods can be held in them until a uniform temperature is attained throughout each package.

In the home, small quantities of foodstuffs can be heated in ovens by spreading the material on trays in layers not more than two inches deep. By the time the surface temperature has reached about 170°F. the centre of the layer should be about 125°F. In gas ovens, this can usually be attained by keeping the flame as low as possible, turning off the gas when the temperature reaches 180°F. and then leaving the material in the oven with the door closed for half an hour. With the aid of a thermometer this treatment can be simply managed in any type of oven but, even in the absence of such an instrument, much can be done by the exercise of a little care. With a flour a temperature above about 170°F. should be avoided, as the baking quality may be seriously impaired by higher temperatures.

With most other products it is usually sufficient to ensure that charring does not take place. Frequent stirring will greatly assist uniform heating and reduce the risk of scorching.

Low Temperature Control.

Cold also may be employed at times as a pest control measure. At moderately low temperatures—40°F. to 55°F.—most foodstuff pests lie dormant and damage in infested goods may be arrested by storage at these temperatures. Several weeks of storage under such conditions will kill many insects. Comparatively short exposures to temperatures below freezing point are also fatal to many species.

Control by Spray Applications.

Sprays of various kinds find a place in the control programme for stored products pests. Most of the commoner sprays employed for this purpose must come in contact with the insects to be controlled and good results can be obtained from their use only if the premises in which the goods are stored are kept clean. Accumulations of spilled stock and debris will frequently protect any insects in them from the sprays and thus impair the efficiency of the whole operation. Due precautions also must be taken to ensure that flour and other susceptible commodities are not tainted by the odour of the spray used.

A fuel oil such as dieselene or some similar product may be sprayed liberally on floors and walls, particularly in grain sheds or other buildings where grains and stock foods are stored. Dunnage also should be treated after being taken up and brushed down. No commodities liable to absorb odours should be allowed to remain in the sprayed section while treatment is in progress and the whole building should be thoroughly aired for at least 24 hours before goods are stacked on the treated area. Liberal treatment with such an oil or even a cruder product is also advisable beneath steps and landing stages, and in other places outside the building where debris accumulates.

Sprays containing a pyrethrum extract and D.D.T. in an oil base, with or without other organic insecticides, are a valuable aid in suppressing stored products pests, notably moths, though they also have a considerable effect on beetles and some other species. Normally these sprays are available as proprietary fly mixtures. They depend for their action not only on their ability to kill many insects when sprayed directly on them but also on the fact that some species, principally moths, are killed if they come in contact with adequately-sprayed surfaces, such as walls of rooms and outsides of cases, even some considerable time after treatment.

Sprays must be applied in an atomised form. All walls and outside surfaces of containers—where accessible—should be sprayed at weekly intervals. When stacks of cases, for instance, are broken during the ordinary working of the store and fresh surfaces exposed, those surfaces

should be treated on the same day. Small hand atomisers are satisfactory for domestic use but for the adequate treatment of warehouses and their contents a power-operated, compressed-air plant operating a gun of the paint-spray type is necessary.

Many fly sprays have a kerosene base and hence are liable to cause tainting of certain commodities. Where the oil base is odourless the risk of tainting is completely eliminated. Unless it is known that an oil of the latter type has been employed in their manufacture, sprays should not be applied directly to the outside of absorbent containers such as sacks.

Fumigation Control Measures.

The use of fumigants in the control of pests of stored products may be discussed conveniently from three aspects, namely (1) fumigation of buildings, (2) fumigation of products in stores and (3) fumigation of products on the farm. In connection with fumigation of stored products, whether in a warehouse or on a farm, it must be remembered that, while efficient fumigation may destroy all insects present at the time of treatment, it will not prevent reinfestation. Fumigated products therefore must be stored in insect-proof containers or on premises as free from infestation as possible. The latter point emphasises once more the importance of sanitation.

Fumigation of Buildings.

The treatment of buildings by fumigants is usually a rather difficult and costly operation and should be undertaken only when simpler measures have failed to keep insect pests in check. Fumigation is not a substitute for routine hygienic measures and, as with spraying, it should always be preceded by a thorough cleaning of the whole premises. Successful treatment is possible only when the buildings can be made reasonably airtight. This is usually difficult to achieve and in poorly-constructed buildings may be almost impossible. The whole operation of fumigation of buildings should be undertaken only by thoroughly trained and experienced persons and is best done by firms which specialise in this type of work. The fumigant most commonly used in the treatment of buildings is hydrocyanic acid gas, which is very poisonous to human beings and animals and must be handled with the greatest care.

Fumigation of Products in Stores.

Stored products may be fumigated in several ways, depending on the type and quantity of material to be treated and on the facilities which are available.

Vacuum chamber fumigation represents the most highly specialised method of treatment but the facilities required for its adoption are rather elaborate and are not generally available. It necessitates the provision of a specially-constructed steel chamber or vault which is capable of withstand-

ing external atmospheric pressure when exhausted of air. After the chamber has been filled with the commodities to be treated, much of the air which it contains is pumped out and replaced by the fumigant. Vacuum fumigation has the three-fold advantage of high efficiency, rapidity of treatment, and economical use of the fumigant. As compared with the 24-36 hours required for treatment by other methods, vacuum fumigation of some commodities may be carried out in as short a period as 90 minutes. Much less fumigant is used than is required normally for treatment by any other method. Vacuum fumigation is particularly valuable for the treatment of tightly-packed goods such as flour and cased dried fruits, which are difficult to deal with by other methods, and also for perishable commodities which must be handled quickly. The fumigants commonly employed in vacuum chamber treatment are ethylene oxide and ethylene dichloride.

Atmospheric chamber fumigation, in which treatment is carried out at normal atmospheric pressure in air-tight buildings or rooms, is used extensively with many types of commodities. A suitable chamber may be constructed fairly cheaply using a non-porous material, though considerable care must be taken to ensure that it is as gas-tight as possible. Provision should be made in such a chamber for the circulation of the gas during fumigation and for removing it after treatment and fittings should be provided for the introduction of the fumigant. In atmospheric chamber fumigation the materials generally used are hydrocyanic acid gas, carbon bisulphide, methyl bromide, ethylene dichlorides and, for some special purposes, ethyl formate.

Fumigation of Products on the Farm.

Bin fumigation is the method most suitable for use on the farm. It involves the treatment of commodities, usually in comparatively small quantities, in some suitable container such as a tank, drum, or well-constructed box which is reasonably air-tight. The goods to be fumigated are placed in the container, the fumigant—which must be of the heavier-than-air type—is then introduced, and the top of the bin is closed with a tight-fitting lid or with a thick layer of canvas or sacking.

Grain, either loose or in sacks, can be fairly satisfactorily treated with a heavier-than-air fumigant under a tarpaulin or other type of covering weighted down at ground level. Rubberized sheets, if procurable, are the best type of covering, but any closely-woven fabric may be used. Success with this method will be achieved only if the floor on which the grain is resting is solid and thus reasonably gas proof.

Carbon bisulphide, one of the oldest fumigants, is still the most suitable for use on the farm and satisfactory results can be obtained with it in bin fumigation, or fumigation under tarpaulins or other coverings. This substance is a heavy liquid with an unpleasant odour. It is highly inflammable and should not be exposed near naked lights, electric switch gear, or hot pipes. When fumigating with it the liquid is poured into

shallow containers or on to several layers of bagging on top of the material being treated. The liquid vaporises and the gas, being heavier than air, sinks towards the bottom of the container, which should be left undisturbed for 36 hours, except in the case of certain seeds, such as cowpeas and related varieties, when only 24 hours' exposure is considered desirable. At the end of the necessary period, the container is opened and the contents aired thoroughly.

The dosage rate in carbon bisulphide fumigation depends on the degree of air-tightness of the container being used. In thoroughly gas-tight tanks and drums, 4 to 5 lb. of carbon bisulphide to every 1,000 cubic feet of container is sufficient. Thus a box measuring 4 feet by 3 feet by 2 feet—24 cubic feet—would require 2 oz. of fumigant if used at the rate of 5 lb. per 1,000 cubic feet. With less gas-tight containers the dosage must be increased until, for treatment under tarpaulins, it should be as high as 15 lb. per 1,000 cubic feet. Best results are obtained at high temperatures and, where possible, fumigation with carbon bisulphide should be avoided when the temperature drops below 70°F.

The risk of tainting foodstuffs with this fumigant is small, except perhaps with some of the more oily products such as nut meats, and airing after treatment is normally sufficient to dissipate any residual odour of the fumigant.

For the present, it appears that carbon bisulphide will continue to fulfil farmers' fumigation requirements. It may be, however, that as they become available in a suitable form, other materials will also be used on the farm for the control of stored products pests.

One other method of treating small quantities of seeds may be used by farmers when these cannot be stored in insect-proof containers and when facilities for fumigation with carbon bisulphide are not available. This method involves adding a mixture of naphthalene and paradichlorobenzene to the bags of seeds. Both these substances are white, crystalline solids, each with a characteristic odour, which vaporise on exposure to the air. The mixture is both toxic and repellent to insects; it kills those already present in the seed and gives a considerable degree of protection against reinfestation for some months. Equal parts by weight of the two substances are thoroughly mixed and then added to the seed at the rate of one to one and a half pounds to each bushel of the material to be protected. The paradichlorobenzene and naphthalene may either be mixed with the seed or distributed evenly through it in small cloth bags, each containing about one half pound of the mixture. As paradichlorobenzene vaporises much more rapidly than naphthalene, any residual crystals will probably be pure naphthalene. These are available for further use if the cloth bag method of distribution has been employed but the necessary amount of paradichlorobenzene, of course, must be added. Grain treated with this mixture retains a characteristic taint and should not be fed to stock.

Notes and Comments.

Malayan Agricultural Services Association.

Representatives of the Field Branch from all parts of the Malayan Union and members of the Research and Education branches of the Department of Agriculture gathered in Kuala Lumpur on Sunday, August 3rd, 1947, to form a Malayan Agricultural Services Association to provide organised and representative liaison between Government and the Junior Agricultural Staff.

The following office bearers for 1947 were elected at the inaugural meeting:—President, Tuan Haji Abdul Wahid, Soils Division; vice-presidents, Che Jafaar bin Mampak, Trengganu; Che Kamarudin bin Bahar, Entomological Division; Tuan Haji Abdul Rahman, Johore; hon. secretary, Che Mohd. Rashid, College of Agriculture; hon. treasurer, Che Ahmat Indot, Soils Division; Committee members, Che Shaffie bin Mohamed Taib, Central Experiment Station, Serdang and Che Ahmad bin Mohamad Said, Field Branch, Serdang, two representatives from Pahang, Johore and Perak and one from the States or Settlements (to be elected); Hon. Auditors, Che Omar bin Buyong, Chemistry Division and Che Mohd. Tamin bin Yeop, College of Agriculture.

Importation of Goats.

The Department imported six, male stud-goats in April of this year, from England. These are stationed at the Central Experiment Station, Serdang, and have been available for stud purposes free of charge.

It is now intended to station one of these goats—a British Saanen—at Kota Bahru, Kelantan, while another—a British Alpine—will be sent to Malacca. One British Toggenburg and one British Saanen are at present being retained at Serdang.

These goats are large animals of a high-milk producing strain, and those who are interested in goat keeping, and wish to obtain the services of these animals, are requested to communicate with the State Agricultural Officers in Kelantan or Malacca, or the Agricultural Officer in charge of the Central Experiment Station, Serdang.

Malayan Agri-Horticultural Association's Exhibition, 1947.

The Eighteenth Malayan Exhibition organised by the Malayan Agri-Horticultural Association was held at Coronation Park, Kuala Lumpur, during the 2nd., 3rd., and 4th. of August, in temporary buildings specially erected for the occasion.

Coronation Park, situated between Birch and Davidson Roads, offered ample space for the Show with parking space for vehicles, cars and cycles. The excellent lay-out of the buildings provided continuous cover for visitors in the event of inclement weather.

Although heavy rain, which fell during the three afternoons prior to the opening date, adversely affected the ground surface to some extent, the high elevation of the Park with its concomitant good drainage provided conditions for the rapid drying of the grounds, and little inconvenience was caused to visitors and exhibitors during the period of the Exhibition when the weather improved. There was an attendance of nearly 83,000 people, about 68,000 of whom paid for admission. Free admission was granted to school children and exhibitors. The Exhibition was the largest staged in the history of the Association.

In requesting His Excellency the Governor, Sir Edward Gent, K.C.M.G., D.S.O., O.B.E., M.C. to open the Exhibition, the President of the Association, Mr. S. B. Palmer, stressed the importance of growing more food, mentioning that any information gained at the Exhibition which would enable the public to increase local food crops, even by a small percentage, would make the holding of the Exhibition well worth while. He also appealed to the public to give more support to the Association.

His Excellency, in his speech, pointed out that the Government had given a lead for the people to follow, and urged padi growers to retain from their crops only what they reasonably required for their own consumption, and for seed purposes, and to sell the surplus to the Government.

The Agricultural Section.

The Agricultural Section comprised the following groups:—padi and rice, food crops and products, beverages, sugar, canned goods, spices, tobacco, arecanuts, fruits, vegetables, oils and fats and essential oils.

A bench space of 720 feet long by 4 feet wide was required to stage the entries, which were housed in a building 120 feet by 50 feet.

The collaboration of State Agricutural Officers throughout the Malayan Union in organising the selecting of competitive exhibits and forwarding them to the Show assisted greatly in raising the quality and number of entries.

The Padi Section.—Despite the high price of rice this section was fairly well filled with entries which necessitated the allocation of 120 feet by 4 feet of bench space. Entries were received from all large rice-growing States of the Union except Kedah and Kelantan.

The quality of the padi entered was superior to that shown at the 1946 Exhibition but not, in general, up to the standard reached before the war.

It is interesting to record that Enche Mat Kassan bin Kasboleh a prize winner at the 1946 Exhibition used this prize padi as seed for his 1947 crop and succeeded in winning the President's silver cup for the best exhibit in the Show. Prizes were fairly evenly distributed amongst all the States competing.

It was not considered opportune to reorganise the "All Malayan Padi Competition" this year although the shield presented for this competition has been recovered by the Association since the liberation of Malaya.

The Fruit Section.—Non-seasonal fruits were well represented especially in the citrus and banana classes, but the entries in the seasonal classes were very poor as a result of the abnormally wet weather which was experienced in most States in January and February. This had the effect of delaying the main fruit harvest, which is normally in July and August, for 3 to 4 months. In consequence a great many entries consisted of unripe fruits, which made the task of the Judges very difficult particularly in the classes for Chiku and Mango. The outstanding exhibits in these classes were the King Oranges, True Oranges and Yellow Rambutans.

Oils and Fats.—These were fairly well represented although the number of entries did not come up to expectations. The classes for soaps were better filled than last year but it would appear that the restricted supplies of caustic soda are adversely affecting the small-scale manufacture of soap.

Classes for prepared ginger are suggested to encourage the cultivation of this crop as an intercrop with pineapples on peat soils.

The copra exhibits were few and disappointing in quality, indicating that the pre-war work by the Department of Agriculture, in the education of small holders in copra drying has been forgotten, or that the facilities to make first grade copra were destroyed during the war. The indications are that small holders again need instruction on copra drying by lectures and demonstrations. It costs less in the long run to produce good copra in an efficient kiln which can be built at little extra expense. Demonstrations and lectures have been recommenced by the Department of Agriculture in coastal coconut areas, using a prefabricated kiln with a capacity of 400 nuts at one loading, which can be assembled and dismantled at short notice and used at any desired centre.

Vegetables.—This class occupied a bench space 240 feet by 4 feet and almost all the classes were represented, those for leaf vegetables being particularly good. Leaf-mustard, and cabbage exhibits from Chinese market gardeners were in great number and contained some fine specimens.

The entries for collections of vegetables were few in number but the exhibits were of good quality.

Beverages.—These were well supported by entries of fair to good quality lowland teas; the classes for various grades of black tea attracted very few entries—The coffee exhibits were of fair to good quality.

Tobacco and Arecanuts.—There were some entries of good quality produce in this Section but the classes were not well filled.

Department of Agriculture.

The exhibits staged in the pavilion of the Department of Agriculture were intended to bring into prominence and thereby stimulate interest in those crops which are of particular importance at the present time. In consequence they were fairly comprehensive and required a temporary building 50 feet by 40 feet with a bench space of 134 feet by 4 feet. In addition, a central kiosk and tables 20 feet by 3 feet were installed for the display of Departmental publications.

Exhibits of pigs, goats and poultry drawn from Agricultural Stations were also shown. These were adjacent to the area occupied by the Veterinary Department for competitive and exhibition cattle and buffaloes.

The central exhibit was padi, designed to illustrate improved methods of cultivation, varietal improvement, and off-season cropping of padi land. Samples of all the principal, Malayan varieties of wet-land padi, now undergoing selection or being studied in regional observations and varietal trials, were shown as padi and as hulled rice. These varieties included Mayang Ebos from Kedah, Kontor from Province Wellesley, Seraup from Krian, Anak Naga from Kelantan, Nachin from Malacca, and Serendah Kunirg from Negri Sembilan. In a few special instances the contrast between hulled rice and highly milled rice was also shown. The more important short-term, wet-land varieties and dry-land varieties were also represented. In addition, padi " blast " disease and vertebrate pests of padi and other crops were shown. In connection with the cultivation of rice and dry land crops a range of photographs was exhibited illustrating the current activities and results of mechanical cultivation.

The vegetative propagation of tea also was demonstrated i.e. the selection of mother bushes and the technique of establishing rooted cuttings.

In view of the growing importance of the rehabilitation of the pineapple canning industry, and the post-war transference of this crop to peat soils in preference to the pre-war practice of planting the crop on upland, undulating, quartzite areas, an exhibit was staged of plants grown on peat soils. The canning side of the industry was illustrated by an excellent series of photographic enlargements. There was also a display of canned fruits.

Hydroponics or the growing of crops in nutrient solutions attracted considerable interest. The exhibit showed the successful growth of several types of food crops in nutrient solution alone and in sand aggregates, irrigated constantly with nutrient solutions. This method of cultivation is still in the experimental stage in Malaya, but as the requisite chemicals become available it is hoped to continue investigations and to publish the results of experiments particularly for the benefit of those living in urban areas.

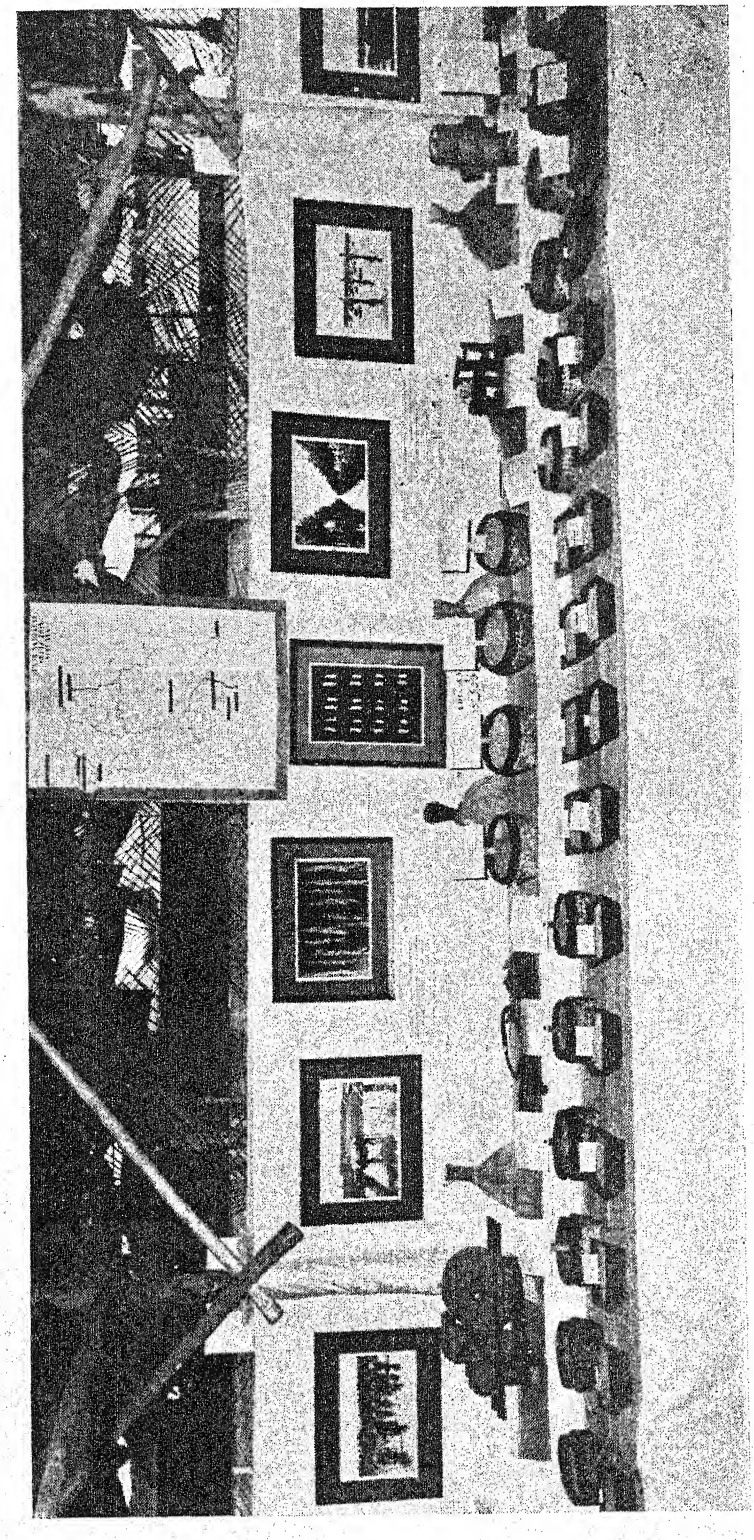
The bud-grafting of fruit trees was demonstrated to show the technique recommended for the successful propagation of durians and rambutans.

Growing plants of Manila hemp were shown along with cleaned fibre of excellent length and lustre and specimens of hand-made ropes. Ramie fibre plants were shown growing in pots.

The species and varieties of derris recommended by the Department were shown growing in tubs. There were also specimens of cleaned root and derris dust.

Profiles of typical Malayan soils were shown, including different types of quartzite, coastal alluvium and padi soils.

A wide range of tropical and temperate climate vegetables, grown at the Kuala Lumpur Experiment Station, were exhibited. These caused con-



Rice Exhibit at Malayan Agri-Horticultural Exhibition, August 1947.

siderable interest and many enquiries were received on the methods of cultivation necessary to achieve such results.

A range of produce from the Agricultural Station, Cameron Highlands was exhibited, comprising several grades of black tea, with a comprehensive collection of temperate climate vegetables; the exhibit also included graded eggs of the Rhode Island Red and White Leghorn breeds of poultry.

Twelve young boars and 12 young gilts with a stud boar of the Middle White breed of pigs were transported from Cameron Highlands in order to illustrate the class of pigs the Department was breeding for distribution in the country.

Pens of Rhode Island Red and White Leghorn pullets were shown with a cock of the same breed in each case. " Night Arks " of an approved design were also exhibited.

In order to demonstrate the Departmental policy of transmitting milking qualities and greater size to the progeny of local goats, bucks of the imported breeds British Alpine, British Saanen and British Toggenberg were shown. Notices inviting goat keepers to have their does mated to these bucks free of cost, were displayed.

A selection of Departmental publications, both English and Vernacular, was also exhibited and over 16,000 leaflets and pamphlets were distributed.

Export of Tea.

It is notified for information that there is no objection to the export of tea in reasonable quantities from the Malayan Union. Applications for licence, which should be made to the Comptroller of Customs in the ordinary way, will be favourably considered.

Report on Malayan Tea.

Samples of tea grown at Tanah Rata Agricultural Station, Cameron Highlands, were forwarded to Messrs. Wilson, Smithett & Co., tea experts of London, who report that " all the grades sent were of very satisfactory manufacture, the flowery, brown, orange pekoe being of excellent appearance and true to grade." The report adds that " the clean, black leaf and bright attractive liquors would appeal to buyers and would meet with keen competition from London dealers and blenders."

The Malayan Nature Journal.

Students of nature will welcome the return of *The Malayan Nature Journal*, the first post-war number of which was published in July. The Journal covers a wide field of observation and includes articles on Malayan birds and cobras and the Malayan Slipper orchids .

The Malayan Nature Society attracted considerable attention before the war. Membership is open to all who are interested in the " natural " things of Malaya, and Mr. A. T. Edgar, the Secretary and Treasurer of the Society, is particularly anxious to increase the Asiatic as well as the European membership. Mr. A. T. Edgar's address is care of Mr. S. B. Palmer, Anglo-Oriental Building, Kuala Lumpur.

Review.

LATEX PRESERVATION, CONCENTRATION AND SHIPMENT

Rubber Research Institute of Malaya: Planting Manual No. 4, 2nd Edition 1947, by J. H. Pidford. Price $2.00.

This publication replaces the original Manual No. 4 of 1932 by Bishop and Fullerton; as, since that time, there have been various new developments and an enormous increase in the export of latex. The present uncertainty in the rubber industry is leading many producers to look for new markets and to consider the export of their rubber in the form of latex rather than smoked sheet.

The author begins with a warning of the difficulties and disadvantages, including the loss of dry rubber, the paramount importance of uniformity, the close supervision, the special handling, packing and shipment.

It is then explained that, firstly, the estate must be suitable for latex production; the field latex should reach an adequate D.R.C. and its colour should be suitable. The behaviour of latex in the creaming process is unpredictable, and mono-clonal rubber may be very different from the average seedling rubber. The author proceeds to deal in detail with the technique, starting with latex in the field, where cleanliness and early preservation with ammonia are so important. Collection bulking and ammoniation are described, along with the final preparation of preserved field latex for export. Centrifugal concentration is next considered, by which means a cream of 60% D.R.C.* is obtained in a high state of purity. This concentrate after being made to absorb the requisite amount of ammonia is ready for export. The operation of the centrifugal machines needs careful control; an inevitable by-product is the skim which contains two-thirds of the original serum and about ten per cent. of the original rubber. In the past this skim might be disregarded, producing as it does an abnormal rubber and being troublesome to deal with. The recovery of this rubber is at present more financially imperative and various methods of so doing are described.

The concentration of latex by use of various creaming agents, and the restrictions created by patents in this field are treated in detail. The advantages of the method lie in the simplicity of equipment and operation, together with low costs and small loss of rubber in the serum. Against this are the sensitivity of the process to field conditions, with day to day variation, the difficulty of reaching 60% D.R.C. and the lower degree of purity; causes which lead to a market preference for centrifugal concentrate.

* Dry Rubber Content.

A brief mention is made of other concentration methods, which are not likely, at present, to be entertained by estate producers. One of these has been operated commercially, namely concentration by evaporation. In this process, the concentrate retains all the original serum solids, and unlike the product previously discussed finds different markets.

In a discussion of preservatives, the use of ammonia is shown to have been almost invariably practised despite search for more desirable substitutes. The advantages possessed by sodium pentachlorphenate are mentioned.

Packing and shipment of latex present numerous problems. Steel drums offer the simplest means, subject to difficulties in the matter of cleanliness and uniformity of contents. Bulk shipment is for the large producer and involves special installations for loading and unloading ships' tanks.

The market standards for latex are stated, and precisely explained, with instructions how to attain and maintain them and make the necessary tests to verify that the product conforms to standard. Lastly the author discusses patents as they affect the producers and gives a guide to the nature of all the known patents concerned with latex processing.

The Manual is thus a most valuable guide to those who are engaging in this branch of the rubber industry or may be contemplating entering it, but, as the author himself states, there are considerable gaps in the knowledge yet to be filled by research and development work.

T. A. B.

Departmental.

FROM THE DISTRICTS

Compiled by the Chief Field Officer from Monthly Reports of Agricultural Officers.

June, July and August, 1947.

The Weather.

There was little rainfall in most districts during the early part of June with hot dry conditions prevailing. Later heavy rainfall was recorded from many districts. On the Selangor coast the south wind began to blow during the last week of June. Some rain was experienced during the first week of July in most States, but after this the weather became hot and dry and continued fine in Kedah, and parts of the east coast, during August, with practically no rain during the greater part of the month. Elsewhere some rain was experienced, with exceptionally heavy rain in parts of Negri Sembilan.

Crop Reports.

Foodcrops and Vegetables.—The census of acreage of essential foodcrops in Malacca for the second quarter revealed a net increase of approximately 2,000 acres bringing the total area under cultivation to 11,087, the highest recorded for the year. Substantial increases were shown in market-garden vegetables, tapioca, sweet potato, groundnuts and maize; the increase in the acreage under maize being directly attributable to assistance in the matter of seed provided by the Department of Agriculture.

Reports from Cameron Highlands state that the output of vegetables was fairly steady at about 400 piculs per day. A greater variety in the vegetables was noted in gardens, and seasonal extension of tomato growing is taking place. Such crops as green pea and celery are being grown, but the major crops are mainly cabbage and leeks. The output of vegetables from the Highlands during August is estimated to have been 750 tons.

In the Seremban and Port Dickson districts of Negri Sembilan, increased planting of root crops was noted during July. Excellent crops of mustard, kale and lettuce were harvested in local market gardens, and large quantities of chilli, bitter gourd, wax gourd and pumpkin were exported from the State.

In the Rembau district there is a holding of 3 acres almost entirely planted with bitter cucumber; the yield is stated to be 6 piculs of fruit per day and for any one crop this yield is maintained for about three weeks. The produce was sold during July at $30 per picul. It is proposed to carry on the cropping of the area with bitter cucumber for about 2 years unless it becomes unprofitable. Cultivation of bitter gourd is still extending in Selangor, and there was at least 50 acres under sole cultivation with this crop during the month of August.

Wet Padi.—Harvest was completed in July at Dusun Tua, Selangor, where it is reported that the use of bat guano gave a 10 to 15 per cent. increase of crop on the poorer plots, but did not materially affect crops on the better land. Ten trial plots with bat guano were laid down during August in padi fields in Ulu Selangor in this season's planting.

In the Segamat district of Johore, 4,561 acres of wet padi were planted by July; of this area 1,572 acres were planted by Chinese. In the same district, Chinese cultivators are continuing to clear new jungle areas which should be ready for short-term, off-season padi after the present main-crop harvest is over.

In Kelantan, harvesting of off-season Taiwan padi was in progress during July. A series of crop-cutting tests was undertaken, and it appears that the strain of Taiwan padi grown is tolerant to a high degree of brackish water. In sandy padi fields, only 200-400 yards from the beach, an average yield of 540 gantangs padi per acre from thirteen cutting tests was obtained while further inland the yield averaged 195 gantangs per acre. At Kuala Pak Amat, on land that had been abandoned owing to the salinity of the water, yields of 400 gantangs of padi per acre of this Taiwan strain have been recorded.

Throughout the State of Negri Sembilan, there are many scattered areas of padi on temporary occupation licence, and planted on estate land, and, recently, thorough investigation in the Seremban and Coast districts by the Staff of the Department has revealed that there are 480 acres of wet padi planted on temporary occupation licence. A number of districts have not yet been investigated and when the whole State has been covered it is estimated that a further 1,500 acres may be recorded.

In Malacca, the Departmental scheme for the distribution of bones was continued, and 2,898 piculs of bones have so far been distributed to padi cultivators. At local rates of application there is sufficient for 5,796 acres. Without this assistance, cultivators would find difficulty in obtaining their requirements as local dealers charge high prices.

Rubber.—In general, prices showed a further slight decline during the past quarter and, for this reason, and because alternative employment was available in the padi fields, many small-holders discontinued tapping. In Selangor, Chinese tappers are finding more lucrative employment in the tin mines.

Coconuts.—The price of copra remained steady and there was a great demand for nuts during the fasting month. In Kelantan, an increased production of coconut sugar was reported.

Miscellaneous Crops.—The tobacco crop in Kelantan and Trengganu is very satisfactory and harvesting is in progress. Fruit production in Negri Sembilan has been excellent and bananas in particular have proved to be a very paying crop. Patchouli is attracting attention in Johore.

Poultry.

Interest in poultry keeping is increasing. The hatcheries in Malacca maintained their output despite a drop in production during July due to shortage of feeding stuffs. The retail price of 25-30 cents for ducklings and chicks remained steady and large numbers of fresh eggs from Johore were sold to the Singapore hatcheries. A new poultry farm has been started up by a Malay at the 27th mile, Johore Bahru—Pontian road and another, in Penang, which is utilizing imported Australian stock. In Selangor, the poultry farms in Klang and Kuala Lumpur are expanding.

Miscellaneous.

Bat Guano Distribution.—Distribution of Bat Guano to padi planters in Kedah and Perlis continued under the direction of the State Agricultural Officer. Up to the end of August, 3,085,080 gantangs had been distributed. Distribution is also beginning in Kelantan.

Destruction of Animal Pests.—Reports from all districts refer to successful measures taken against Wild Pigs. Record numbers were shot by hunters in Malacca and Kelantan during August. In Perak it is hoped completely to eliminate this pest when further guns and ammunition are available.

Fresh-Water Fish.—A good trade is being developed in Selangor in "Haruan", an excellent fresh-water fish. Up to a picul a day is being exported.

DEPARTMENTAL NOTES

Mr. C. W. S. Hartley, Agricultural Officer, has been appointed to officiate as Agricultural Officer-in-Charge Central Experiment Station, Serdang, with effect from 16th August, 1947.

Mr. H. J. Simpson, Agricultural Officer, has been appointed to officiate as Agricultural Officer, Penang and Province Wellesley, with effect from 16th August, 1947.

Mr. O. M. Lee, Agricultural Officer, returned from leave on 15th July and assumed duty on 16th July as Agricultural Officer (attached) College of Agriculture, Malaya.

Mr. F. C. Cooke, Canning Officer, has been granted 155 days leave on full pay with effect from 13th September, 1947.

Mr. P. V. Ormiston, Agricultural Officer, Johore North, went on transfer to Cameron Highlands on 22nd September, 1947.

Mr. B. G. A. Lowe, Agricultural Officer, Cameron Highlands, went on transfer to Johore Central on 23rd September, 1947.

Statistical

MARKET PRICES.

September 1947.

Rubber.—During July the Singapore price of rubber advanced from 26 cents per lb. at the beginning of the month to 31½ cents per lb. at the end of the third week but dropped to end the month at 29⅝ cents per lb. The decrease in price continued during August and the month closed with the price at 28 cents per lb. This price remained constant for the first two days of September after which the price advanced slowly to close at 32⅜ cents per lb. on the last day of the month.

The average prices paid for small-holders' rubber at three centres during the third quarter of 1947 are given in Table I.

Table I.

Average Weekly Prices Paid by Local Dealers for Small-Holders' Rubber, July-September, 1947.

(Dollars per picul of 133⅓ lbs.)

Grades	Ipoh, Perak.			Kuala Pilah, Negri Sembilan.			Batu Pahat, Johore.		
	July	Aug.	Sept.*	July	Aug.	Sept.*	July	Aug.	Sept.*
Smoked Sheet ..	33.40	32.50	34.23	32.87	32.44	33.67	28.41	29.46	31.65
Unsmoked Sheet ..	28.00	26.50	27.67	27.44	27.44	29.84	24.08	27.16	28.29
Scrap ..	10.38	12.50	12.67	8.38	8.75	10.17	14.01	9.89	11.30

Transport from Batu Pahat to Singapore by lorry, excluding duty, $1.00 per picul.
* Average of prices for first three weeks of September only.

Table II.

Singapore Prices of Various Agricultural Products.

Product	September, 1947			August 1947	Average Price Jan.-Oct. 1941
	Highest	Lowest	Average	Average	
	per picul $	per picul $	per picul $	per picul $	per picul $
Copra:					
Sundried No. 1 ..	23.50	20.00	22.27	20.94	2.58
No. 2 ..	*	*	*	*	2.33
No. 3 ..	*	*	*	*	*
Coconut Oil ..	37.00	32.00	34.50	32.80	8.64
Coffee:					
Padang Bali No. 1 ..	93.00	85.00	89.50	102.30	*
No. 2 ..	90.00	81.00	85.39	97.30	*
Palembang No. 1 ..	65.00	57.00	60.65	58.20	18.07-19.91
Sourabaya New No. 1	70.00	70.00	70.00	74.20	19.13-21.02
Bali Old ..	*	*	*	*	*
Pepper:					
Muntok White ..	134.00	123.00	127.85	117.40	15.33
Lombong White ..	*	*	*	*	*
Sibu White ..	*	*	*	*	*
New Black ..	*	*	*	*	*
Old ..	*	*	*	*	*
Sarawak ..	130.00	121.00	125.00	115.3	*
Siam Black ..	*	*	*	*	*
Nutmeg:					
No. 1 ..	*	*	*	*	25.19
No. 2 ..	*	*	*	*	23.66
Cloves:					
Indian ..	43.00	40.00	42.13	42.9	*
Sumatra ..	50.00	46.00	47.00	51.5	*
Gambier:					
Rounds No. 1 ..	128.00	125.00	125.23	*	13.65
No. 2 ..	110.00	110.00	110.00	*	*
Cake ..	*	*	*	*	*
Sago Flour:	15.85	14.65	15.45	15.12	*
Lingga ..	*	*	*	*	*
Local No. 1 ..	*	*	*	*	*
No. 2 ..					
Tapioca Flour:					
Malayan No. 1 ..	29.00	29.00	29.00	28.80	*
No. 2 ..	26.00	26.00	26.00	25.80	*
Java ..	*	*	*	*	*

* Not quoted.

MALAYAN UNION PRODUCTION OF PALM OIL AND KERNELS.

(In long tons as declared by Estates)

Month 1947	Palm Oil	Palm Kernels
January	2,238.2	292.3
February	2,316.9	337.1
March	2,585.8	386.2
April	2,410.2	380.2
May	2,377.7	359.9
June	2,451.2	336.1
July	3,479.4	452.6
Total ..	17,859.4	2,544.4
Total May-December, 1946 ..	11,756.4	931.6 (Aug.-Dec.)
Total Jan.-Sept., 1941 ..	38,588.4	2,332.5
Total for the year 1940 ..	57,972.1	9,611.2

Stocks on estates as at 31st July, 1947, were: palm oil 2,056 tons, palm kernels 378 tons.

In July 33 estates (planted acreage 70,828.4 acres) were in production out of a total of 46 oil palm estates (planted acreage 77,981.4 acres).

MALAYAN AGRICULTURAL EXPORTS, FEB.-MAR., 1947.

Product	Net Exports in Tons.			
	Year 1940	Jan.-Oct. 1941	February 1947	March 1947
Arecanuts	43,915	24,633	1,844	258*
Coconuts fresh†	131,469†	178,404†	2,683†	3,055†
Coconut oil	69,446	65,045	4,185	3,268
Copra	9,004*	32,682*	1,885*	3,433*
Copra cake	1,215*	5,659*	360*	384*
Gambier, all kinds ..	321	489	78	93
Palm kernels	9,219	1,984	406	321
Palm Oil	56,091	44,406	2,090	12,226
Pineapples, canned ..	40,243	15,086	161	2
Rubber¶	547,202¶§	500,982¶§	50,003¶	58,782¶
Sago,—flour	2,525	1,752*	1,840	1,046*
„ —pearl	4,848	6,217	753	1,247
„ —raw	4,816*	4,400*	648*	842*
Tapioca,—flake ..	762	601	5	8
„ —flour ..	2,649*	4,310*	1,045	1,225
„ —pearl ..	17,004	15,164	Nil	562
Derris	1,258	998	52	70

† hundreds in number. * net imports. ¶ production.
§ Malayan Union and Singapore.

MALAYAN UNION RUBBER STATISTICS.

Estates of 100 Acres and over. Production July, 1947.

In Dry Tons.

STATE	PRODUCTION						STOCKS		PREPARED LATEX PRODUCTION	
	European	Chinese	Indian	Others	Total	Total Jan./July 1947	Beginning of Month	End of Month		
(1)	(2)	(3)	(4)	(5)	(6)	(7)				
Perak ..	4,709	399	230	25	5,363	32,890	4,478	4,520	Preserved field Latex	877
Selangor ..	5,433	436	99	8	5,970	35,308	5,143	5,157		
N. Sembilan ..	4,144	298	135	110	4,687	28,511	3,266	3,206		
Pahang ..	1,248	610	99	—	1,957	12,416	1,424	1,553	Centrifuge Concentrate	1,472
Malacca ..	1,305	374	87	—	1,766	11,116	1,624	1,351		
Penang & P. Wellesley	400	74	4	—	478	2,716	412	415	Revertex	175
Johore ..	5,999	1,256	241	639	8,135	46,041	5,440	5,392		
Kedah ..	3,669	442	116	25	4,252	25,438	3,171	3,294		
Perlis ..	—	2	22	—	24	151	21	22		
Kelantan ..	471	61	—	23	555	2,920	548	581		
Trengganu ..	120	57	—	2	179	1,010	159	145		
Total ..	27,498	4,003	1,033	832	33,366	198,517	25,686	25,636		2,524

Notes:—1. Figures for production of prepared latex for export are included in the month's production figures, columns 2 to 6.

2. Production by estates of less than 100 acres for July, 1947, was estimated to be 20,407 tons. Total estimated small-holding production January to July, 1947, 166,115 tons.

3. Total latex production 1946, 5,223 tons. Latex production June, 1947, field latex 876 tons, centrifuge 1,245 tons revertex 133 tons.

4. Stocks on estates of less than 100 acres are not ascertained.

5. The above forms part of the July rubber statistics published by the Acting Registrar of Statistics, Malayan Union, at Kuala Lumpur, on 23rd August, 1947.

MALAYAN UNION RUBBER STATISTICS.

Acreages of Tappable Rubber Actually Tapped and not Tapped on Estates of 100 Acres and over for the Month ending 31st July, 1947.

STATE	Estimated Acreages of Tappable Rubber (9) + (11)	Acreage of tappable Rubber not tapped: On estates which have entirely ceased tapping		On estates which have partly ceased tapping (a)		Area of tappable rubber never been tapped (b)		Total Area not tapped (3) + (5) (c)		Total Area tapped during the month (c)		Area of tappable rubber rested under rotational systems (c)	
		Acreage	% of (3) to (2)	Acreage	% of (5) to (2)	Acreage	% of (7) to (2)	Acreage	% of (9) to (2)	Acreage	% of (11) to (2)	Acreage	% of (13) to (2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Perak ..	272,926	1,569	.6	40,988	15.0	11,843	4.3	42,557	15.6	230,369	84.4	22,122	8.1
Selangor ..	325,276	1,837	.6	41,030	12.6	12,527	3.9	42,867	13.2	282,409	86.8	16,120	5.0
N. Sembilan ..	256,658	3,866	1.5	56,599	22.1	21,888	8.5	60,465	23.6	196,193	76.4	16,195	6.3
Pahang ..	92,676	798	.9	17,287	18.6	8,265	8.9	18,085	19.5	74,591	80.5	5,033	5.4
Penang & P. Wellesley ..	28,045	1,628	5.8	3,174	11.3	892	3.2	4,802	17.1	23,243	82.9	5,803	20.7
Malacca ..	121,542	2,185	1.8	15,257	12.6	4,893	4.0	17,442	14.4	104,100	85.6	10,599	8.7
Johore (d) ..	458,200	9,897	2.1	94,266	20.6	31,120	6.8	104,163	22.7	354,037	77.3	31,800	6.9
Kedah ..	194,224	669	.3	32,454	16.7	12,881	6.6	33,123	17.0	161,101	83.0	21,283	11.0
Kelantan ..	29,916	215	.7	4,298	14.4	1,050	3.5	4,513	15.1	25,403	84.9	7,196	24.1
Trengganu ..	15,028	388	2.6	6,079	40.4	1,232	8.2	6,467	43.0	8,561	57.0	797	5.3
Perlis ..	1,837	—	—	372	20.3	164	8.9	372	20.3	1,465	79.7	290	15.8
Total ..	1,796,328	23,052	1.3	311,804	17.3	106,755	5.9	334,856	18.6	1,461,472	81.4	137,238	7.6

Notes:—(a) Area out-of-tapping on estates which have partly ceased tapping refers to areas definitely being rested and excludes area on any tapping round.

(b) The acreage shown in column (7) is included in columns (3) and (5).

(c) Areas of tappable rubber rested under rotational systems are not considered as out-of-tapping and therefore columns (11) and (12) include columns (13) and (14) respectively.

(d) Registered estates only.

(e) This table was published by the Acting Registrar of Statistics, Malayan Union, on 25th August, 1947.

MALAYAN UNION RUBBER STATISTICS.

Summary of Stocks, Production, Imports and Exports of Rubber, July, 1947.

In Long Tons, Dry Weight.

		Tons	Tons
STOCKS (30th June)			
Estates	..	25,686	
Dealers	..	52,190	
Ports, awaiting shipment	..	9,507	87,383
IMPORTS	..		2,889
PRODUCTION			
Estates	..	33,366	
Small-holdings (estimated)	..	20,407	53,773
Total	..		144,045

		Tons	Tons
EXPORTS			
Foreign	..	29,297	
Local (to Singapore)	..	22,336	51,633
LOCAL CONSUMPTION	..		143
STOCKS (31st July)			
Estates	..	25,636	
Dealers	..	58,958	
Ports, awaiting shipment	..	7,675	92,269
Total	..		144,045

Note:—The above forms part of the July rubber statistics published by the Acting Registrar of Statistics, Malayan Union, at Kuala Lumpur, on 23rd August, 1947.

MALAYAN UNION PADI STATISTICS.

Area of Land Planted and Yields of Padi Season 1946—1947.

STATE	Wet			Dry			Total Wet and Dry Padi	
	Acres	Gantangs	Average Yield (Gantangs per Acre)	Acres	Gantangs	Average Yield (Gantangs per Acre)	Acres	Gantangs
Perlis ..	36,640	10,320,000	281	60	6,200	103	36,700	10,326,200
Kedah ..	236,820	61,820,000	261	4,255	373,500	88	241,075	62,193,500
Kelantan ..	133,722	23,308,647	174	29,813	2,982,639	100	163,535	26,291,286
Trengganu ..	34,876	5,635,617	161	18,182	2,479,480	136	53,058	8,115,097
Penang & P.Wellesley ..	37,736	8,840,280	234	590	79,275	134	38,326	8,919,555
Perak ..	106,140	17,753,000	167	15,040	1,337,000	89	121,180	19,090,000
Selangor ..	34,520	8,682,800	252	4,890	457,100	93	39,410	9,139,900
Pahang ..	39,787	7,224,800	182	4,409	380,180	86	44,196	7,604,980
N. Sembilan ..	29,612	5,807,970	196	36	1,035	29	29,648	5,809,005
Malacca ..	30,611	5,688,820	186	120	23,700	198	30,731	5,712,520
Johore ..	12,142	966,611	80	3,449	170,621	49	15,591	1,137,232
Total ..	732,606	156,048,545	213	80,844	8,290,730	103	813,450	164,339,275

164,339,275 Gantangs of Padi = 246,756 tons of Rice.

(Conversion: 666 Gantangs of Padi equals 1 ton of Rice).

METEOROLOGICAL SUMMARY, MALAYA, JULY, 1947.

Locality.	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes								Most in a day.	Number of days							
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total			Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
										ins.	m.m.	ins.								
Ipoh, Perak ..	92.4	72.5	82.5	97	69	86	77			8.73	221.7	3.54	13	12	3					
Port Swettenham, Selangor	89.7	72.0	80.9	94	69	84	75	84.2	84.8	6.05	153.7	2.75	13	10	1					
Sitiawan, Perak ..	88.7	72.6	80.7	91	69	83	75			4.77	121.2	2.06	10	9	2	1				
Kuala Lipis, Pahang ..	89.8	72.7	81.3	93	70	84	75	83.7	85.3	3.66	93.0	0.90	10	8		22				
Kuantan, Pahang ..	90.0	72.1	81.1	94	70	82	75			2.54	64.5	1.23	10	5		1				
Bayan Lepas, Penang .	87.7	74.5	81.1	90	71	84	77			5.00	127.0	1.42	10	10						
Malacca ..	85.9	74.7	80.3	89	72	80	80			2.32	58.9	0.51	11	11	1					
Mersing, Johore ..	87.2	72.5	79.9	91	70	79	76			4.46	113.3	2.34	8	7	15					
Alor Star, Kedah ..	88.9	74.0	81.5	93	71	78	77			8.89	225.8	2.99	16	15		1				
K. Trengganu, Trengganu	89.1	73.3	81.2	92	70	83	75			1.76	44.7	1.27	7	4	2					
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. ..	73.7	62.9	68.3	78	60	68	65	71.1		5.60	142.2	2.12	12	10		6				
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	73.4	54.7	64.1	78	47	69	60	69.8		9.30	236.2	2.88	17	16		1				

NOTICE.

Department of Agriculture, Malayan Union.

The Director of Agriculture invites those interested to visit the Central Experiment Station and the College of Agriculture, Serdang, and also the other Experiment Stations, Agricultural Stations, Padi Experiment Stations, and Padi Test Stations, of the Department in various parts of the Peninsula.

Intending visitors to the Central Experiment Station should communicate with the Senior Agriculturist. Visitors' days at the Central Experiment Station are the first and third Wednesdays in each month. Intending visitors to the College of Agriculture should communicate with the Principal.

The Central Experiment Station and the College of Agriculture are situated about 14 miles by road from Kuala Lumpur and 3 miles from Serdang Railway Station.

Stations are listed below together with the addresses of officers to whom enquiries should be sent.

AGRICULTURAL STATIONS.

Kedah.

Gajah Mati Agricultural Station.—*State Agricultural Officer, Kedah, Alor Star.*

Kelantan.

Central Experiment Station, Kota Bharu.
Bachok Agricultural Station.
Pasir Mas Agricultural Station.
Melor Experiment Station.
State Agricultural Officer, Kelantan, Kota Bharu.

Penang and Province Wellesley.

Ayer Itam Agricultural Station.
Bukit Mertajam Agricultural Station.
Agricultural Officer, Penang and Province Wellesley, Butterworth.

Perak,

Simpang Lima Agricultural Station.
Selama Agricultural Station.
Agricultural Officer, Perak North, Taiping.
Kuala Kangsar Agricultural Station.
Ayer Tawar Agricultural Station.
Agricultural Officer, Perak Central, Kuala Kangsar.
Degong Agricultural Station.
Tanjong Malim Fruit Nursery.
Agricultural Officer, Perak South, Teluk Anson.

Selangor.

Central Experiment Station, Serdang.
Experiment Station, Kuala Lumpur.
Coconut Experiment Station, Port Swettenham.
Senior Agriculturist, Central Experiment Station, Serdang.
Cheras Agricultural Station.
Telok Datoh Agricultural Station.
State Agricultural Officer, Selangor, Kuala Lumpur.

Pahang.

Kuala Lipis Agricultural Station.
Raub Agricultural Station.
State Agricultural Officer, Pahang, Raub.
Temerloh Agricultural Station.
Malay Agricultural Officer, Pahang South, Temerloh.